COwZ User's Guide

Zonal Indoor Source Emission and Dispersion Model, Version 1

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PREFACE

Development of the COwZ model (COMIS with sub-Zones) was funded by a grant from the Queen's University Environment Science and TechnOlogy Research (QUESTOR) Centre, which is an industry-university co-operative research centre. The aim of this project was to develop improved and more practical methods for modelling indoor air quality, which includes emission, transport and dispersion of indoor pollutants. The approach taken was to nest sub-zones within a multizone model, COMIS, and add the necessary functionality to the combined program.

In addition to inheriting all the features of COMIS, COwZ has the capability to predict air flows within rooms, heat transfer and pollutant dispersion between and within rooms, and pollutant source emission rates within rooms.

This COwZ User's Guide contains an overview of the COwZ project, subdivision of single rooms, and the construction of the input file needed to run the calculation program COwZ, particularly concentrating on those aspects which are new for COwZ. See the COMIS User's Guide edited by Feustel and Smith (1997) for those aspects which are not modified.

Contents

1. Introduction

1.1 General

Two main categories of mathematical model widely used to predict indoor air flows, temperature and pollutant concentration distributions are: microscopic scale models, which use computational fluid dynamics (CFD) to calculate the values of all relevant parameters at closely-spaced points in all parts of the flow field with a high degree of resolution; and macroscopic scale models (including multizone and zonal models).

Multizone programs typically operate using the approximation that conditions inside a room (zone) are uniform and then model the air flow through links or flow paths between zones. A model is set up by identifying all of the zones of concern and the links between those zones and with the outside air. The links are specified by their flow properties and flow rates determined by the pressure differences across the links. The network of links is then described by a series of flow equations which are solved simultaneously to provide a mass conserving solution. COMIS (Feustel 1999), together with the CONTAM series (Walton 1997 and Dols 2001) probably represent state-of-the-art in multizone models. Multizone models are simpler, quicker and cheaper to use than CFD. But they cannot predict detailed airflow, temperature and concentration distributions within single rooms of a building. So for practitioners who focus on the macroscopic features of airflow and contaminant dispersal among rooms, not within rooms, multizone models are effective tools.

A zonal model is an intermediate approach between CFD and multizone models. In this approach a room is divided into several macroscopic homogeneous zones in which mass and heat conservation must be obeyed. The model will provide some information about thermal airflow within a room, and it should be relatively easy for users to define the problem. It could easily be incorporated into building thermal analysis software and multizone infiltration models. Zonal models are always based on two main assumptions: that we are able to predict the main driving flows (boundary layer, jet or thermal plume) and we have a sufficiently good empirical knowledge of these phenomena to calculate their characteristics. There is still much work needed to improve knowledge about these. Current zonal models are only applied to single rooms with a limited set of driving forces.

It would be a significant step forward to add the potential to pre dict varying conditions inside one or more rooms to a multizone model which predicts conditions throughout a building and accounts for the influence of the external atmosphere. Multizone models include such boundary and driving conditions as ex/infiltration through windows, doors, cracks and ventilation systems. It would be necessary to enhance any candidate zonal model to cope with all of the potential flow paths in a 'parent' multizone model.

COMIS (Conjunction Of Multizone Infiltration Specialists) is a multizone air flow and contaminant transport model with a modular structure, developed by an international collaborative research effort under the auspices of the International Energy Agency. It is the most popular public domain multizone model and there is obvious potential for it to become a standard for multizone air flow modelling. COMIS has been chosen as the starting point for our work and the necessary functionality was added to COMIS. The new model (COMIS with sub-zones) is abbreviated to COwZ.

1.2 The COwZ model

COwZ involves nesting sub-zones within a multizone model. The main idea behind this method is that when a room or space in a building is not well mixed (for example, there is thermal or concentration stratification), the room is sub-divided into regions with similar air flow patterns and temperature regimes. Other well-mixed rooms are treated as single zones. For clarity the term sub-zone will be used to indicate a sub-divided air space in an individual room. Two types of sub-zone are used: standard sub-zones and mixed sub-zones. Standard sub-zones are assumed to have a uniform air temperature and pressure which does not differ markedly from their immediate neighbouring sub-zones. The important characteristic of these sub-zones is that flow velocities (and momentums) between them are small and primarily driven by pressure differences. Mass flows between adjacent sub-zones are calculated in different ways for horizontal and vertical interfaces. A mixed sub-zone contains two parts: one contains air belonging to the flow element and one contains air from the surroundings. The driving forces of flow elements are jets, thermal plumes, boundary layers, and fans etc. Specific models have been developed to describe flows for some typical examples of these. The equations for standard sub-zones are reused to calculate air flows from the surroundings. Mass and energy balances are made for each zone (sub-zone). The solution of the non-linear system of equations, based on mass and energy balances for each zone (sub-zone), provides the pressure and temperature fields. When source strength is known or a source emission model has been used, concentration fields can also be calculated for pollutants based on the conservation of mass for each contaminant species in each zone (sub-zone).

The new program contains three significant developments, not present in other multizone models. Firstly, a zonal model, which allows individual rooms to be arbitrarily sub-divided into smaller sub-zones, was nested within COMIS, which is described in next section. This allows resolution of airflow rates, temperatures and pollutant concentrations within rooms. The key task was to calculate the airflow rates between adjacent sub-zones. Fourteen new flow links were added to the 13 already available in COMIS. Collectively, these methods can calculate airflow for a range of cases of practical interest.

Secondly, a suitable thermal model has been developed and incorporated in COwZ to account for the effects of temperature on airflow and contaminant emission and dispersion. After an extensive review, 19 convection coefficient correlations were incorporated. Two solution methods were implemented for the thermal energy equations: one for whole buildings and the other for single sub-divided rooms.

Thirdly, three zonal source emission models have been developed and implemented in COwZ. The emission calculations use local-scale input data, rather than 'whole room' average data and will therefore be more accurate in most circumstances.

2. Subdivision of single rooms

2.1 Introduction

Usually, sub-zones are rectangular parallelepipeds set side by side (see Figures 1 and 2). This simplifies the subdivision of rooms that it makes it easy to line up each other. But for nonrectangular rooms, the sub-zones may be other shape (for example, Figure 3 shows sub-zones near a sloping ceiling).

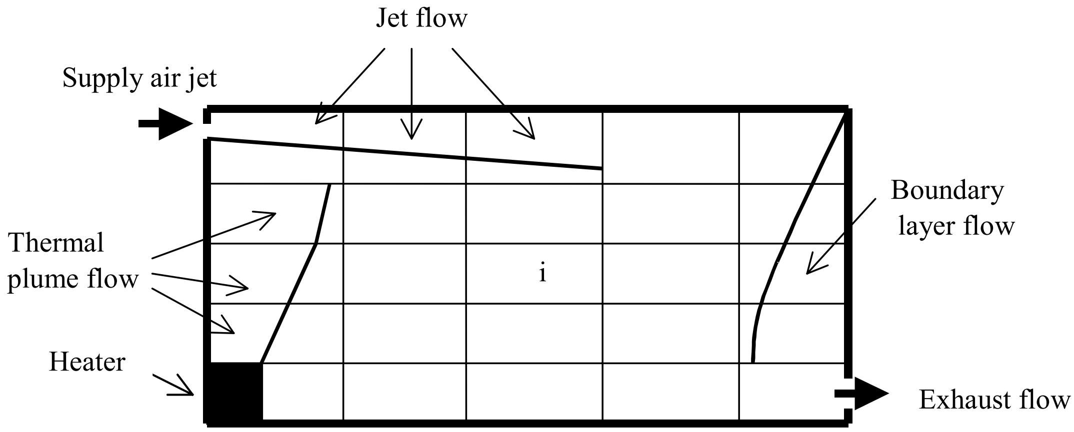

Fig. 1 Example of a room divided into sub-zones

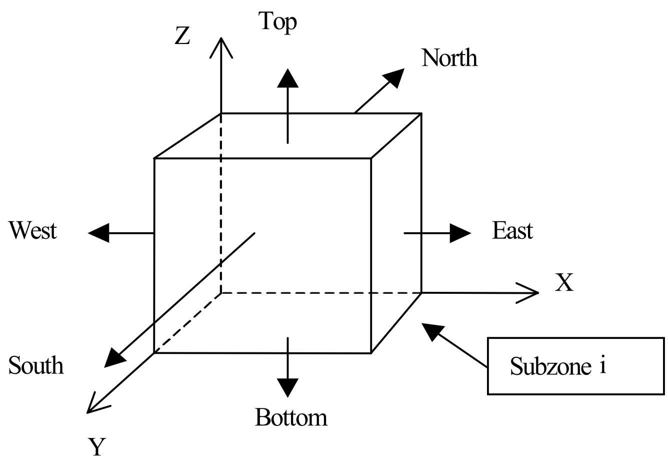

Fig.2 Geometry of a sub-zone in COwZ

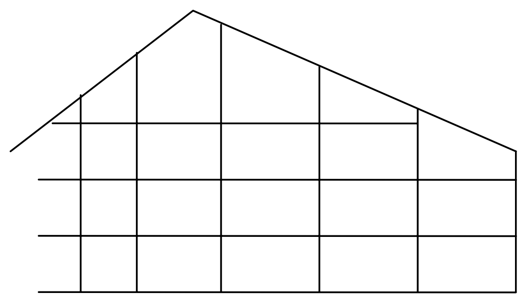

Fig.3 Geometry of a sub-zone near a sloping ceiling

When starting to subdivide a room, it is necessary to identify the flow elements and their trajectories (including penetration length, width and height of the flow element). The other parts of the room are treated as standard sub-zones. The flow elements should be contained in the corresponding flow element sub-zones. See next sub-section for details. The COwZ model allows different size sub-zones. The temperature and concentration within a sub-zone are assumed to be uniform, course grids (large sub-zones), and high temperature and concentration gradients may make this assumption poor. The size of sub-zones mainly depends on the resolution accuracy of user's requirement, gradients of temperature and/or concentration, and type of the sub-zone (standard or flow element sub-zone).

For flow element sub-zones, usually, the temperature gradients are larger (for example, a thermal plume or a thermal boundary near a hot wall surface), small sub-zones are needed, but

large enough to contain the flow element. For a thermal boundary flow element sub-zone, the size is between 0.1 ~ 0.5m. For a thermal plume, the width of the sub-zone is determined by the width of the thermal plume (usually, 0.1~1.0m). For a jet, the size of the sub-zones is determined by the local height/thickness of the jet flow (usually, 0.1~1.5m).

For standard sub-zones, the temperature and concentration gradients are usually smaller (without pollutant sources), the size is between 0.25~1.5m. If pollutant source presents, smaller sub-zones are needed.

2.2 Implementing sub-zones in COwZ

In COwZ, a building is described by a set of nodes interconnected by flow paths (links). Each node (zone or sub-zone) represents a room or part of a room. COwZ has three types of zone: undivided rooms, standard sub-zones and mixed sub-zones. Undivided rooms have been addressed in COMIS. This section will focus on the implementation of sub-zones in COwZ.

In a sub-divided room, two types of sub-zone are used: standard sub-zones and mixed sub-zones. Models have been developed to describe flows between adjacent standard and mixed sub-zones (Ren, 2002). For example, Figure 4 shows a ventilated room with a two-dimensional isothermal ceiling jet.

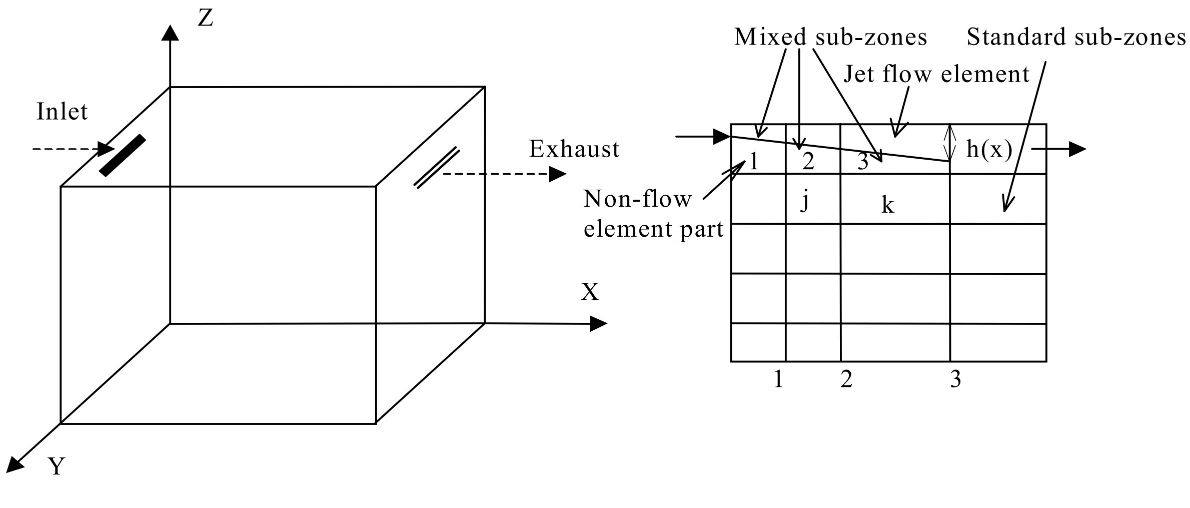

Fig.4 Sub-zones with jet models

There is a flow element (a two-dimensional isothermal ceiling jet) in this room. To subdivide this room, at first the penetration length l_{re} and the height of the jet flow in section, h, are needed to be estimated by equations (1) and (2). See Ren's thesis for details. In this short room the jet reaches the end wall and exhausts through the outlet. Then the standard sub-zones can be identified.

$$l_{re} = 4.1H \tag{1}$$

$$h(x) = 0.16x \tag{2}$$

where H is the height of the room and x is Cartesian coordinate.
Figure 4 shows a example of subdividing this room into 60 (4×3×5) sub-zones (three are mixed sub-zones 1, 2 and 3), and the others are standard sub-zones.

To ensure that a mixed sub-zone is large enough to encompass the flow element part (for example, see Figure 5 for sub-zone 2), the depth ΔY_i and height ΔZ_i of the mixed sub-zone i should be:

$$\Delta Y_i \geq l_0 \quad \text{and} \quad \Delta Z_i \geq h(x_i) \tag{3}$$

where l_0 is the width of the diffuser.

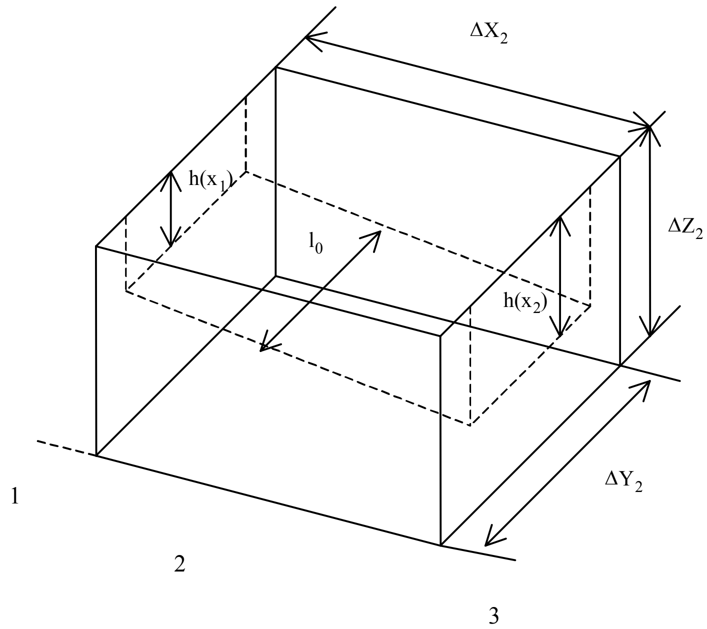

Fig. 5 Dimensions of sub-zone 2

Air flow rates between adjacent standard sub-zones are described below.

For air flow across vertical interfaces,

$$m_{j,i} = C_d \rho A \left| p_j - p_i \right|^n \left(\frac{p_j - p_i}{\left| p_j - p_i \right|} \right) \tag{4}$$

For air flow across horizontal interfaces,

$$m_{j,i} = C_d \rho A \left| \left(p_j - p_i\right) - \frac{g}{2}\left(\rho_i h_i + \rho_j h_j\right) \right|^n \left[\frac{\left(p_j - p_i\right) - g(\rho_i h_i + \rho_j h_j)/2}{\left|(p_j - p_i) - g(\rho_i h_i + \rho_j h_j)/2\right|} \right] \tag{5}$$

where C_d is the discharge coefficient and ρ refers to the density of incoming air. A is the cross-sectional area and g is gravitational acceleration. p and h are the pressure and height of the sub-zone respectively.

Air flow rate $q(x_i)$ at interface x_i for the jet can be calculated by equation (6),

$$q(x) = 0.25q_0\sqrt{\frac{x}{b_0}} \tag{6}$$

where b_0 is the height of the diffuser.

In this section the focus is on calculating the air flow rates for the 'non-flow element air'.

As shown in Figure 4, for mixed sub-zone *2* the non-flow element part will have air mass transfer with mixed sub-zone *1* and *3* in x-direction and with standard sub-zone *j* in z-direction. It also has air mass transfer with two adjacent standard sub-zones in the y-direction. The calculations of these air flow rates are described below.

From equation (4), the air flow rate, $m_{1,2}$, between the non-flow element air of mixed sub-zones *2* and *1* is

$$m_{1,2} = C_d \rho A_{1,2}|p_1 - p_2|^n\left(\frac{p_1 - p_2}{|p_1 - p_2|}\right) \tag{7}$$

and

$$A_{1,2} = \Delta Y_2 \times \Delta Z_2 - l_0 h(x_1)$$

$$h(x_1) = 0.16x_1$$

Similarly, the air flow rate, $m_{2,3}$, between the non-flow element air of mixed sub-zones *2* and *3* is

$$m_{2,3} = C_d \rho A_{2,3}|p_2 - p_3|^n\left(\frac{p_2 - p_3}{|p_2 - p_3|}\right) \tag{8}$$

and

$$A_{2,3} = \Delta Y_2 \times \Delta Z_2 - l_0 h(x_2)$$

$$h(x_2) = 0.16x_2$$

In the y-direction, when the depth of mixed sub-zone *2*, ΔY_2, is larger than l_0, the air flow rate between the non- flow element part of mixed sub-zone *2* and standard sub-zone *i*, $m_{2,i}$, can be estimated by equation (4), where the interface area is given by (see Fig. 5),

$$A_{2,i} = (X_2 - X_1)\Delta Z_2 = \Delta X_2 \Delta Z_2$$

but when $\Delta Y_2 = l_0$, and the jet is two-dimensional, there is no mass transfer between the flow element and the adjacent standard sub-zone in the y-direction, so the mass transfer interface area between the non flow element part in mixed sub-zone *2* and the adjacent sub-zone *i* is given by (see Fig. 5),

$$A_{2,i} = \Delta X_2 \left[\frac{\Delta Z_2 - h(x_1) + \Delta Z_2 - h(x_2)}{2} \right]$$

In the z-direction, from equation (5) the air flow rate between the non flow element part in mixed sub-zone *2* and standard sub-zone *j* is,

$$m_{j,2} = C_d \rho A_{j,2} \left| (p_j - p_2) - \frac{g}{2}(\rho_2 h_2 + \rho_j h_j) \right|^n \left[\frac{(p_j - p_i) - g(\rho_2 h_2 + \rho_j h_j)/2}{\left| (p_j - p_2) - g(\rho_2 h_2 + \rho_j h_j)/2 \right|} \right] \tag{9}$$

and

$$A_{2,j} = \Delta X_2 \Delta Y_2$$

$$h_2 = \frac{\Delta Z_2 - h(x_1) + \Delta Z_2 - h(x_2)}{2}$$

This method can be extended to other mixed sub-zones with different flow elements.

The proposed overall implementation structure follows the modular structure of COMIS. After data input, the pressures in each standard sub-zone and the non flow element part of the mixed sub-zone are initialised and then updated by solving a system of non-linear mass balance equations using the Newton-Raphson. The iteration ends when convergence is achieved.

3. Getting started – an overview of COwZ

3.1 Model structure

COMIS comprises more than two hundred and thirty subroutines working together to simulate air flows and pollutant transport between rooms. The outline structure of the original COMIS 3.0 system (preciously called COMVEN) is shown in Figure 6 (Dorer and Weber, 1995). A general outline of how COMVEN works can be found in the Programmer's Guide of COMVEN (Dorer and Weber, 1995). More detailed information is given in the source code and especially in the respective comment lines.

To extend COMIS for the new technique, a number of modifications to COMIS were made:

1) the input file was extended.
2) three significant new capabilities were added:
    a) sub-zonal air flows within rooms;
    b) heat transfer modelling;
    c) pollutant source emission modelling.
3) the database was modified to contain new links, pollutant properties, etc, and

4) the output files were extended.

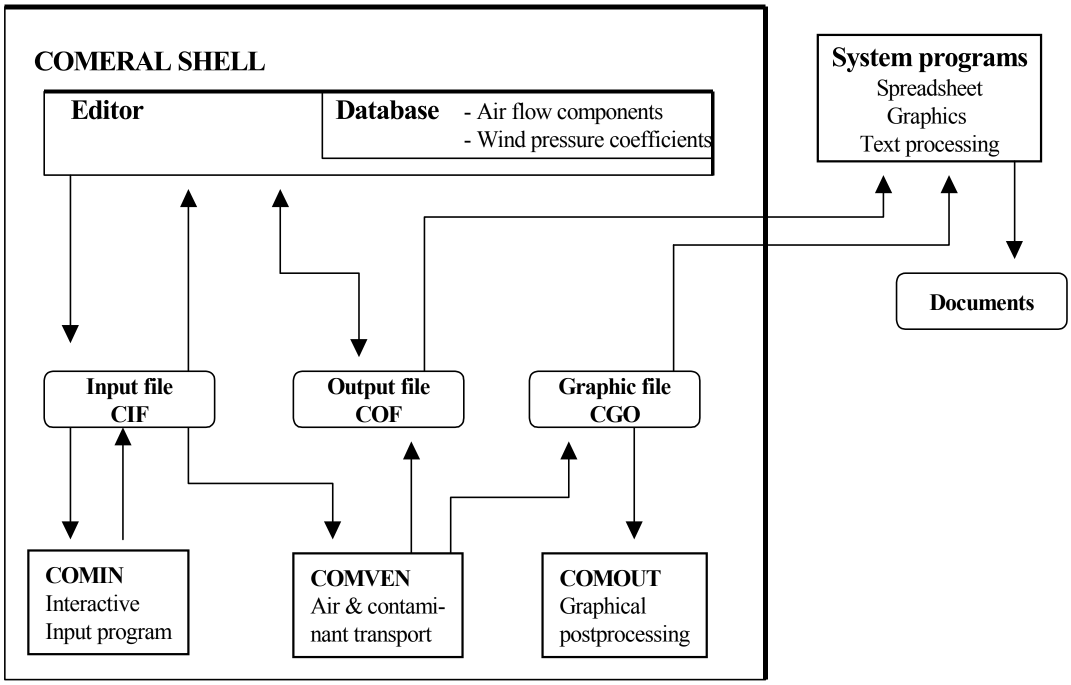

Figure 6 The general structure of COMIS (adapted from Dorer and Weber, 1995)

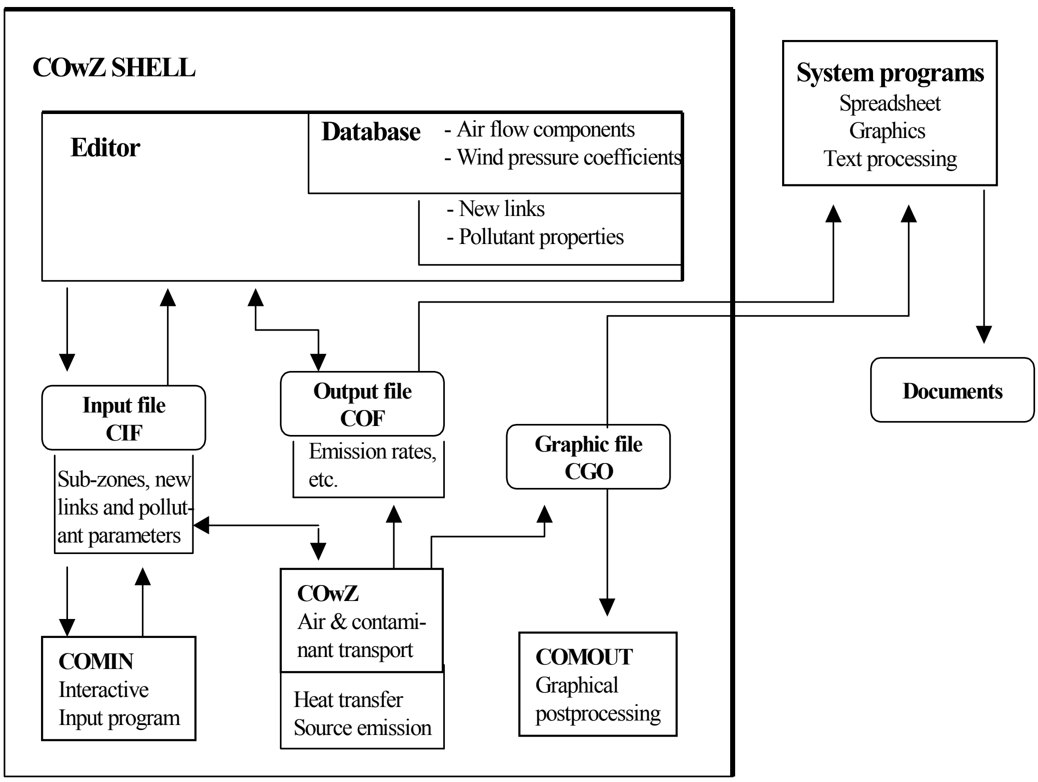

Figure 7 The general structure of COwZ

This resulted in the revised structure for COwZ, shown in Figure 7.

In more detail, and based on COMIS, the sequence of steps involved when executing COwZ is shown in Figure 8. The more detailed description of each step and new aspects for COwZ are described in Zhengen's PhD thesis (Ren 2002).

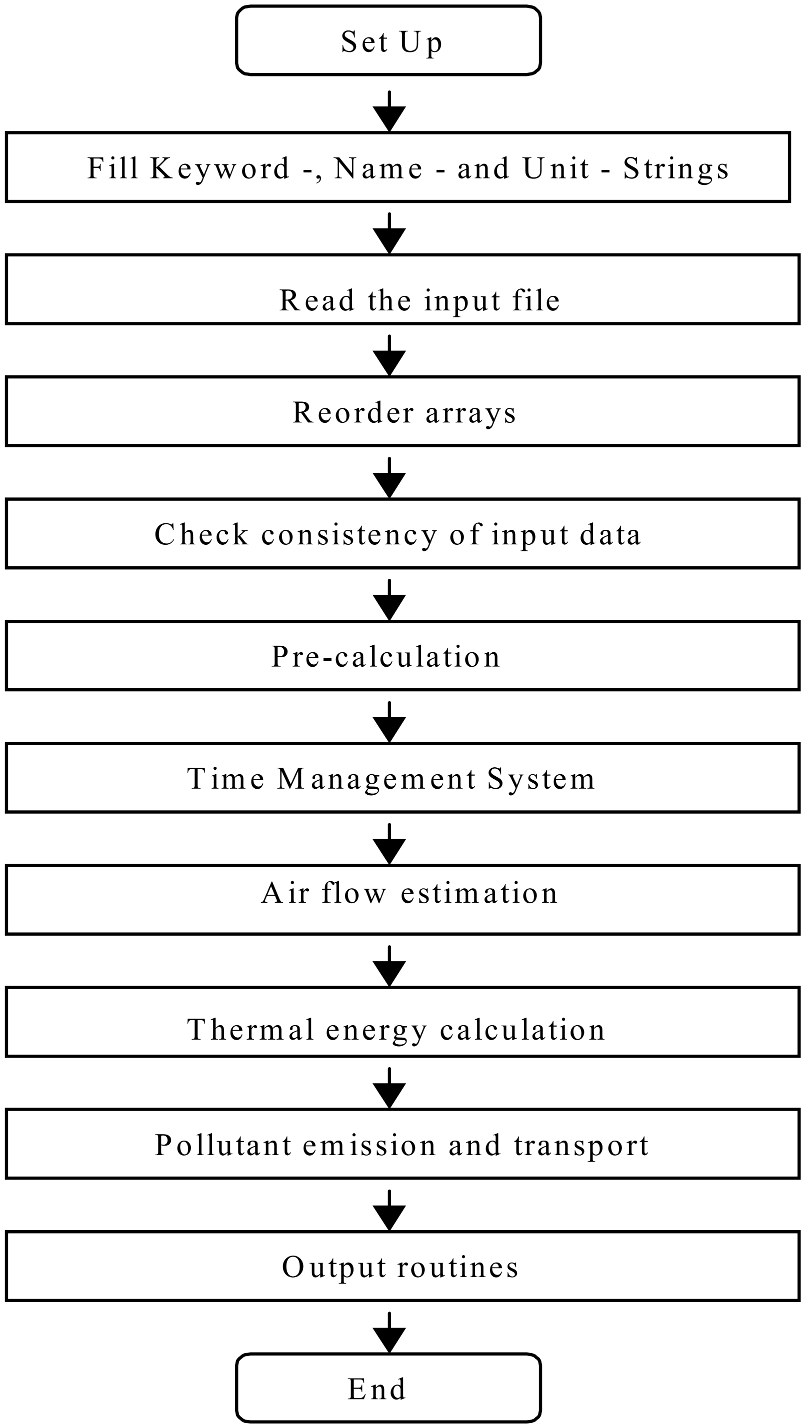

Figure 8 Execution steps of COwZ

3.2 How to get started

Following the modular structure of COMIS, most subroutines of COMIS have been modified (but most of the names of routine are not changed) and some subroutines have been added for the new features. If you are working with COMIS 3.0, you only need copy the modified and new subroutines to replace the source code of COMIS. The COwZ distribution CD contains all the source code. COwZ with the existing input file **cowz.cif** has been successfully compiled using Digital Visual Fortran version 5.0 and version 6.0. For this operating system, the system requirements are:

- Pentium, Pentium Pro, or Pentium II processor-based computer;
- Microsoft Windows NT 4.0 or Windows 95 (serial version only);
- 16 MB of RAM (32 MB preferred);
- 10 MB of available hard-disk space;
- CD-ROM drive.

To use COwZ under Digital Visual Fortran one must obtain the COwZ source code and recompile the programs for this system. It includes three steps:

1) to set active project (under menu ***Project*** click *Set Active project* and name the project (for example **subzone**), and then click *Add (Files) to Projec*t to add all the files to the program **subzone**);
2) to build **subzone.exe** (under menu ***Build***, click *Build subzone.exe*) which includes linking and compiling the program; and
3) to execute **subzone.exe** (under menu ***Build***, click *Execute subzone.exe*) and get results.

To use COwZ under other operating systems users should refer to the installation and compilation of COMIS (COMIS 3.0 – User's Guide edited by Feustel and Smith, 1997).

To begin working with COwZ it is recommended that users **read this User's Guide for the new features and the User's Guide for COMIS 3.0 for those features which have not been modified.**

It is strongly recommended that users first become familiar with COMIS before using COwZ. We have not attempted to include here all the background knowledge and experience needed to use COMIS.

After compiling COwZ, users need to modify the input file, which is described in the next section. There is usually no need to recompile the program for different studies.

4. Input data description and input format

4.1 Structure of input file

The designers of COMIS paid special attention to data input and output methods (Feustel and Smith, 1997). Although there are several enhanced versions of COMIS with graphical user interfaces, in this study the basic version 3.0 of the program written in Fortran 77 with text-based inputs and outputs is used. The input file of COMIS, a simple text editor based input file, was modified for the implementation of new features and re-named COwZ.CIF. The *COMIS 3.0 User's Guide* gives a detailed description of data input (Feustel and Smith, 1997). The general structure of the input file and the modifications for COwZ are shown in Figure 9.

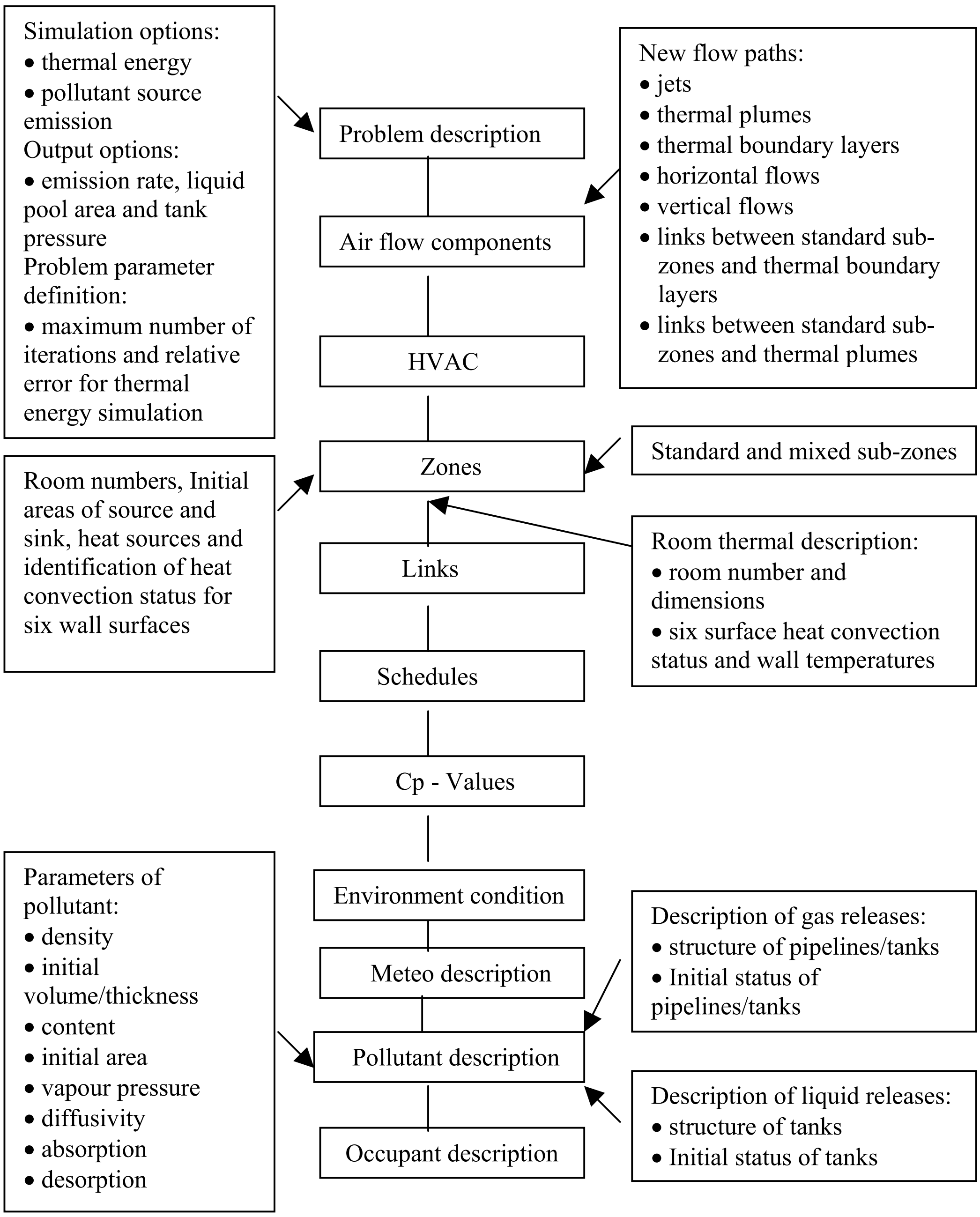

Figure 9 Structure of data input file and the modifications for COwZ

The blocks on the left of the figure have been added to the input data sections associated with existing COMIS keywords. The blocks on the right have been added to the input data sections with new keywords. The description of the parameters is structured according to the sequence of data sections and data blocks given in the input file. The input data are obtained by the routine ***inpdat*** which reads lines from the CIF file via ***INH***, together with the sequence number of the keyword for each data section and the sequence number of the data line after the keyword. The parameters are stored in common blocks. There have been many changes to the input file CIF, which will be described below in detail. For the parts that are not changed, see the *COMIS3.0 User's Guide* (Feustel and Smith, 1995).

4.2 Problem description

4.2.1 Simulation options

Keyword:

&-PR-SIMUlation options

Header:

Simulation Option Keywords: one keyword per line Keywords may be preceded by NO		
VENT: ilation	POL:lutant	HEAT: flow
CONC:entrations	INPUT echo	DEFAULT echo
SET echo	UNIT	SSPILL liquid
MSPILL	VOC coating	GAS release
LIQ (liquid release)		
SCHED: time <time>		
START: time		
STOP : time		

For the following new simulation options, each new keyword may be given on a single input line.

HEAT:flow	Calculation with thermal simulation model (COMIS 3.0 only allows the calculation of ventilation and concentrations).
POL:lutant	Pollutants are taken into account (if no source emission model is given, the emission rate is a constant or varies with a factor).
SSPILL liquid	Source emission modelling for single component evaporation from a liquid pool.
MSPILL	Source emission modelling for multi-component solvent evaporation from a liquid pool.
VOC coating	Source emission modelling for VOC emission from paint.
GAS release	Source emission modelling for gas release from storage tanks or pipelines.
LIQ (liquid release)	Source emission modelling for liquid release from storage tanks or pipelines.

4.2.2 Problem output options

Keyword:

&-PR-OUTPut options

Header:

Output Option Keywords: One keyword per line		
Keyword {Link/zones} Define data to be stored (append-S for Storing each value or –T for mean values for the Total simulation period):		
PZ {Zones}= Pressure/zone	FL{Links}= Flow/link	HZ{Zones} = Humidity/zone
TZ {Zones} = Temp./zone	TL {Links} = Temp./link	IZ {Zones}= Infil/zone
FZ {Zones} = Flow/zone	SL {Links} = Status	AZ = ACH
WA = Wind Velocity	HA = Outdoor Humidity	MZ {Zone} = Age of air/zone
Cn {Zones} = Concentr.	TA = Air Temp.	EZ {Zones} = Ach index/zone
Sn {Zones} = Poll. Sink	Qn {Zones}=Poll. Source	PE {Points} = Wind pressure
PT = Pressure of storage tank	GA = Source Emission rate	PA = Area of liquid pool
HZ = Humidity/zone	IZ = Infil/zone	FB = Flow matrix/building
MB = Arithmetic mean of building mean age of air		
RB = RMS of building mean age of air		
NB = nominal time constant of building mean age of air		
EB = ACH efficiency of building	LB = Ventilation heat loss energy of building	

The new output options are:

TZ: Each zone temperature.
PT: Pressure of storage tanks or pipelines.
GA: Source emission rate of indoor pollutant.
PA: Area of liquid pool.

4.2.3 Problem control parameter definition

Keyword:

&-PR-CONTrol parameters **--- OPTIONAL DATABLOCK---**

Header:

2. | use old __ | pressure 0 =zero pressure 1=use previous 2=recalculateair density after every iteration step UseOPz [-]	No Pressure Initialization 0=Lin.initial. 1=No initial. NoInit [-]	Max Number of Iterations allowed for thermal simulation Nitt [-]	Relative error for thermal simulation convergence EpsTR [-]	Max Number of Iterations allowed for air flow Miter [-]

The added parameters are Nitt and EspTR, which are described below.

Parameters	Description	Input Format	Default value
Nitt	If a solution is not found before the given number of allowed iteration steps, the program breaks and reports that the output for this step may be wrong	Integer	10000
EspTR	Temperature relative tolerance per zone	Real	1.0e-5

4.3 Network description

4.3.1 Air flow components

MAIN Keyword:

&-NET-AIR flow components

```
# COMIS allowed prefixes are:
# *CR   *FA    *DS    *DF    *F1    *F2   *F3    *F4     *WI     *TD     *RF      *PS
#   |        |        |        |        |                            |         |         |          |          |
#   |        |        |        |        |________________|         |         |       related flow |
#  crack    |      duct        |         flow-controllers            |      testdata points         |
#           fan              duct-fitting                       window(openable)       passive stack
# new added prefixes are:
#  *JE      *WL      *WP       *HF       *VF      *BL                              *BL
#    |           |           |           |           |        |                                  |
#    |           |           |  horizontal flow |   balance between                   balance between
#  jet           |     thermal plume            |   standard zone and thermal layer     standard
#          wall thermal-layer           vertical flow                                    zone and
#                                                                                      thermal plume
```

4.3.2 Jets

Keyword:
&-JE jet

Header:

I I	Cd (-)	Alfa (-)	Zmo (kg/s)	b0 (m)	xl (m)	u0 (m/s)	dT0 (K)	A0 (m2)

Example input:

```
*JEje_1
    1      1.0          1.0       0.13         0.4       0.4        0.1      2.0           0.2
```

Description:

Parameters	Description	Input Format	Default
I I	Number of jet types list in table 1	Integer	1
Cd	Air mass flow coefficient for type 1 jets listed in table 2	Real	0.25
Alfa	Air flow exponent listed in table 2	Real	0.5
zmo	Air flow rate of the diffuser	Real	0.2
b0	Characteristic length of diffuser listed in table 2	Real	0.1
xl	The centre line distance from the diffuser	Real	1.0
u0	The initial air flow velocity for jets of type 2 to type 5	Real	0.1
dT0	The initial temperature difference between the jet and the ambient fluid dT0 for jets of type 2 to type 5	Real	1.0
A0	The area of the diffuser for jets of type 2 to type3	Real	0.1

Number of Jet type I I	Jet types
1	Five types of jets listed in Table 2
2	Circular vertical thermal jets when the momentum and gravity forces act in the same directions
3	Circular vertical thermal jets when the momentum and gravity forces act in the opposite directions
4	Plane vertical thermal jets when the momentum and gravity act in the same directions
5	Plane vertical thermal jets when the momentum and gravity forces act in the same directions

Table 1 Jet types which are classified for calculation of mass flow rate used in COwZ

Jet type	Flow coefficient C_d [-]	Power Alfa [-]	Characteristic length b_0 [m]
Two-dimensional isothermal ceiling jet	0.25	0.5	Thickness of the diffuser
Wall non-isothermal horizontal jet	0.25	0.5	Thickness of the diffuser
Plane turbulent free horizontal jet	0.3728	0.5	Half thickness of the diffuser
Circular turbulent horizontal jet	0.32	1.0	Diameter of the circular jet
Radial jet	0.445	1.0	Half width of two spaced circular discs
Circular vertical thermal jet	-	-	Thickness of the diffuser
Plane vertical jet	-	-	Thickness of the diffuser

Table 2 Input data of C_d, Alfa and b_0 for jets

4.3.3 Thermal boundary layer flow

Keyword:
&-WL thermal boundary layer flow

Header:

Height (m)	Depth (m)	Width (m)	Cd (-)	Tw (K)	zl (m)

Example input:
*WLwl_1
1.0 1.5 1.0 0.04 33.0 1.0

Description:

Parameters	Description	Input Format	Default
Height	Height of thermal layer zone	Real	1.0
Depth	Depth of thermal layer zone	Real	1.0
Width	Width of thermal layer zone	Real	1.0
Cd	Flow coefficient (for laminar flow, Cd=0.0024 and for turbulent flow, Cd=0.0021)	Real	0.0024
Tw	Wall temperature	Real	20.0
zl	The distance from the leading edge of the thermal boundary layer	Real	1.0

4.3.4 Thermal plume

Keyword:
&-WP thermal plume

Header:

Height (m)	Depth (m)	Width (m)	Cd (-)	Beta (-)	Hsf (W)	Z0 (m)	Zl (m)

Example input:
*WPwp_1
0.5 0.5 1.0 0.006 1.0 300.0 0.4 1.0

Description:

Parameters	Description	Input Format	Default
Height	Height of thermal plume zone	Real	0.5
Depth	Depth of thermal plume zone	Real	0.5
Width	Width of thermal plume zone	Real	0.5
Cd	Flow coefficient listed in table 3	Real	0.006
Beta	Air flow exponent listed in Table 3	Real	1.0
Hsf	Heat emission from the heat source	Real	300.0
Z0	The location of the virtual origin of the flow	Real	0.0
Zl	Height of the plume	Real	0.0

Thermal plume type	Coefficient C_d [-]	Power Beta [-]
Circular plume	0.006	5/3
Plane plume	0.014	1
Wall plume	0.0032	5/3

Table 3 Input data for C_d and *Beta* for thermal plumes

4.3.5 Horizontal flow

Keyword:
&-HF air flow between two horizontal standard subzones

Header:

Height (m)	Width (m)	Cd ($m/Pa^{0.5}$ s)

Example Input:
*HFhf_1
0.2 1.1 0.83

Description:

Parameters	Description	Input Format	Default
Height	Height of the interface	Real	0.5
Width	Width of the interface	Real	0.5
Cd	Air flow discharge coefficient	Real	0.83

4.3.6 Vertical flow

Keyword:

&-VF air flow between two vertical standard subzones

Header:

Height (m)	Depth (m)	Width (m)	Cd ($m/Pa^{0.5}$ s)	Hi (m)	Hj (m)

Example input:

*VFvf_1

0.2	1.1	0.5	0.83	0.2	0.8

Description:

Parameters	Description	Input Format	Default
Height	Height of zone	Real	0.5
Depth	Depth of zone	Real	1.0
Width	Width of zone	Real	0.5
Cd	Air flow discharge coefficient	Real	0.83
Hi	Height of zone i	Real	0.5
Hj	Height of zone j	Real	0.5

4.3.7 Link between standard subzone and thermal boundary layer

Keyword:

&-BL air mass balance link between subzone and thermal boundary layer

Header:

Height (m)	Depth (m)	Width (m)	Cd ($m/Pa^{0.5}$ s)	Tw (K)	Zl1 (m)	Zl2 (m)

Example input:

*BLbl_1

0.5	1.0	0.5	0.0024	30.0	0.5	1.0

Description:

Parameters	Description	Input Format	Default
Height	Height of thermal layer zone	Real	0.5
Depth	Depth of thermal layer zone	Real	1.0
Width	Width of thermal layer zone	Real	0.5
Cd	Air flow coefficient	Real	0.0024
Tw	Temperature of wall	Real	20.0
Zl1	Bottom section distance from the leading edge of thermal layer	Real	0.0
Zl2	Top section distance from the leading edge of thermal layer	Real	0.5

4.3.8 Link between standard subzone and thermal plume
Keyword:
&-BP air mass balance link between standard subzone and thermal plume

Header:

Cd (m/Pa $^{0.5}$ s)	Hsf (W)	Beta (-)	Z0 (m)	Z1 (m)	Z2 (m)

Example input:
*BPbp_1
0.006 300.0 1.0 0.5 0.5 1.0

Description:

Parameters	Description	Input Format	Default
Cd	Air flow coefficient listed in Table 3	Real	0.006
Hsf	Heat emission of thermal plume heat source	Real	300.0
Beta	Air flow exponent listed in Table 3	Real	1.0
Z0	Location of the virtual origin of the flow	Real	0.0
Z1	Height of bottom section of thermal plume	Real	0.0
Z2	Height of top section of thermal plume	Real	0.5

4.3.9 Zones
Keyword:
&-NET-ZONes

Headers:

Zone ID (-)	Name (-)	Temp [°C]	Ref. height [m]	Vol [m^3] H/D/W [m]	Abs. Hum. [g/kg]	A01 [m^2]	A02 [m^2]	Heat s. Hps [W]

IZR (-)	ZTE	ZTS	ZTW	ZTN	ZTC	ZTF	Schedue names [T./H./]

Example input:
zone_1 zone_1 20.0 0.0 0.2/1.1/0.5 0.0 0.5 0.5 100.0
1 0.0 1.0 0.0 1.0 0.0 1.0 CO2

Description for the added inputs:

Parameters	Description	Input Format	Default
A01	Initial area of pollutant source	Real	0.0
A02	Initial area of pollutant sink	Real	0.0
Hps	Heat source	Real	0.0
IZR	Room number where heat convection occurs	Integer	1
ZTE	East surface for heat convection (0/no; 1/yes)	Real 0.0/1.0	0.0
ZTS	South surface for heat convection (0/no; 1/yes)	Real 0.0/1.0	0.0
ZTW	West surface for heat convection (0/no; 1/yes)	Real 0.0/1.0	0.0
ZTN	North surface for heat convection (0/no; 1/yes)	Real 0.0/ 1.0	0.0
ZTC	Ceiling surface for heat convection (0/no;1/yes)	Real 0.0/ 1.0	0.0
ZTF	Floor surface for heat convection (0/no; 1/yes)	Real 0.0/1.0	0.0

4.3.10 Thermal description of rooms

Keyword:
&-WHEAT room thermal description

Header:

NRO [-]	Hr [m]	Dr [m]	Wr [m]	RTE [-]	RTS [-]	RTW [-]	RTN [-]	RTC [-]	RTF [-]

TWE [°C]	TWS [°C]	TWW [°C]	TWN [°C]	TWC [°C]	TWF [°C]	Rach [h^{-1}]	Uop [m/s]	Widz [m]

Example input:
1 2.5 3.5 4.0 1 1 1 1 1 1
20.0 20.0 20.0 20.0 20.0 20.0 1.0 0.1 0.1

Description:

Parameters	Description	Input Format	Default
NRO	Room number for heat convection occurs	Integer	1
Hr	Height of the room	Real	3.0
Dr	Depth of the room	Real	3.0
Wr	Width of the room	Real	3.0
RTE	East surface convection status listed in Table 4	Integer	1
RTS	South surface convection status listed in Table 4	Integer	1
RTW	West surface convection status listed in Table 4	Integer	1
RTN	North surface convection status listed in Table 4	Integer	1
RTC	Ceiling convection status listed in Table 4	Integer	1
RTF	Floor surface convection status listed in Table 4	Integer	1
TWE	Internal east surface temperature	Real	20.0
TWS	Internal south surface temperature	Real	20.0
TWW	Internal west surface temperature	Real	20.0
TWN	Internal north surface temperature	Real	20.0
TWC	Internal ceiling surface temperature	Real	20.0
TWF	Internal floor surface temperature	Real	20.0
Rach	Air change rate of the room	Real	0.0
Uop	Air velocity at the nozzle opening	Real	0.0
Widz	Width of the nozzle opening	Real	0.0

No. of α correlation	Heat convection configuration	Formula for heat convection coefficient α		
		Wall surfaces	Ceilings	Floors
1	Adiabatic	0	0	0
2	Steady state natural convection	CIBSE[1]	CIBSE	CIBSE
3	Natural convection (excluded heating devices)	Alamdari and Hammond[2] for vertical surfaces	Alamdari and Hammond for horizontal surfaces	Alamdari and Hammond for horizontal surfaces
4	Natural convection caused by heating devices	Khalifa and Marshall[3] for vertical surfaces	Khalifa and Marshall for ceilings	Awbi and Hatton for floors
5	Ceiling jets in isothermal rooms	Fisher[4] for walls	Fisher for ceiling	Fisher for floors
6	Free horizontal jets in isothermal rooms	Fisher[4] for walls	Fisher for ceiling	Fisher for floors
7	Mixed convection	Awbi and Hatton[5] for walls	Awbi and Hatton for ceiling	Awbi and Hatton for floor
1. CIBSE (1988) 2. Alamdari and Hammond (1983) 3. Khalifa and Marshall (1990) 4. Fisher (1995) 5. Awbi and Hatton (2000) All the data or correlations are given in Chpater 4 of Zhengen's PhD thesis (Ren, 2002)				

Table 4 Formula for convection heat transfer coefficient α implemented in COwz

4.3.11 Flow element zone

Keyword:
&-NET-ZF flow element zone

Header:

Zone ID [-]

Example input:
*fzone_1

Description:

Parameter	Description	Input Format	Default
Zone ID	Flow element zone identification	string = 8 Char	-

4.3.12 Supply parameters

Keyword:
&-SUPPLY

Header:

Supply zone number Nsu (-)	Supply Temperature Tsu (°C)	Supply Concentration Csu (kg/kg)

Example input:

2 20.0 0.0

Description:

Parameters	Description	Input Format	Default
Nsu	Zone number of the diffuser supplying	Integer	1
Tsu	Air temperature of the diffuser supplying	Real	0.0
Csu	Concentration of the diffuser supplying	Real	0.0

4.4 Description for source emission modelling

COwZ has included three types of pollutant source emission model: non-boiling evaporation from liquid pools, VOC emission from thin coating materials (paints), and gas and liquid releases. The input data for source emission modelling are classified into three types: parameters of pollutant for liquid spills and wet paints, initial status and structure of pipelines/tanks for gas releases from pipelines or tanks, and initial status and structure of tanks for liquid releases from tanks. They are described below.

4.4.1 Pollutant parameters

In COMIS, the input data for pollutant descriptions (*POL-DES*) are pollutant sequence number, name and molar mass. In COwZ, single- and multi-component contaminants are considered in source emission models. For single component pollutants, following the keyword (*POL-DES*) the additional input data are vapour pressure, liquid density, initial pool volume, initial pool area, diffusion coefficient, adsorption rate constant and desorption rate constant. For multi-component pollutants, following the keyword (*POL-DES*) TVOC (Total Volatile Organic Compound) is listed first (sequence number '1') and the components of the mixture then follow in sequence (2, 3 etc.). For TVOC (the mixture) the input data are name, product density, initial thickness, initial area, content fraction, adsorption rate constant and desorption rate constant. For each component the input data are sequence number, name, molar mass, molar fraction, vapour pressure, diffusion coefficient, adsorption rate constant and desorption rate constant.

Keyword:

&-POL-DEScription

Header:

No (-)	Name (-)	Molar Mass [g/mol]	Mol./Cont. Fraction [mg/g]	Vapour Pressure [mm Hg]	Diffusivity [m^2/h]	Adsorp. Ka [m/h]	Desorp. Kd [1/h]

Density [kg/l]	Initial volume|thickness [ml|um]	Initial area [m^2]

Example input:

1 C3H7OH 60.096 1000.0 31.67499 0.036 0.0 0.0

0.9 500.0 1.2

Description:

Parameters	Description	Input Format	Default
No	Number of pollutant |component in a solvent	Integer	1
Molar mass	Name of pollutant	String<20 char	Polluta.
Mol./Con. Fraction	Molar fraction for each component of TVOC Content fraction for TVOC	Real	1000.0
Vapour Pressure	Vapour pressure of pollutant	Real	0.0
Diffusivity	Diffusion coefficient of pollutant	Real	0.0
Ka	Adsorption rate constant of pollutant	Real	0.0
Kd	Desorption rate constant	Real	0.0
Density	Density of pollutant	Real	0.0
Initial Vol./ Thickness	Initial pool volume|initial paint thickness	Real	0.0
Initial area	Initial pool area|initial paint area	Real	0.0

4.4.2 Initial status and structure of pipelines/tanks for gas releases

For gas releases from pipelines/tanks, the pollutant name and molar mass are provided following the keyword (*POL-DES*), and the other parameters following the keyword (*GAS-REL*). The additional input data are release type (pipeline or tank), initial total mass in the pipeline/tank, initial gas pressure of the pipeline/tank, initial gas temperature, initial gas volume of the pipeline/tank, pollutant heat capacity at constant pressure, pollutant heat capacity at constant volume, puncture area, discharge coefficient, length of pipe, pipe friction factor, pipe diameter and heat of vaporization of the liquid.

Keyword:

&-GAS-RELease

Header:

Release Type [-]	Total Mass [kg]	Initial Pressure [Pa]	Initial Temp [K]	Initial Volume [m^3]	Cp [J/gK]	Cv [J/gK]	Punct. Area [m^2]	Disch. Coeff. [-]

Pipe length [m]	Pipe diameter [m]	Pipe friction factor [-]	Liquid heat Vapor. [J/kg]

Example input:

```
 1          50.0      20000.0       300.0     20.0          1043.0    742.9      0.0001        0.8
 20.0                          0.20             0.7              1.1E5
```

Description:

Parameters	Description	Input Format	Default
Release type	Gas release from pipelines (1)/tanks(2)	Integer 1or 2	Default
Total mass	Total pollutant mass in pipeline/tank	Real	0.0
Initial pressure	Initial gas pressure in the pipeline/tank	Real	0.0
Initial temperature	Initial gas temperature	Real	0.0
Initial volume	Initial gas volume in the pipeline/tank	Real	0.0
Cp	Pollutant heat capacity at constant pressure	Real	1043.0
Cv	Pollutant heat capacity at constant volume	Real	742.0
Puncture area	Puncture area where gas releases from	Real	0.0
Discharge coefficient	Discharge coefficient for orifice	Real	0.8
Pipe length	Length of the pipeline	Real	0.0
Pipe diameter	Diameter of the pipe	Real	0.0
Pipe friction factor	Friction factor of the pipe	Real	0.7
Liquid heat vaporization	Heat of vaporization of the pollutant liquid	Real	0.0

4.4.3 Initial status and structure of tanks for liquid releases

For liquid releases from tanks, the pollutant name and molar mass follow the keyword (*POL-DES*), and the other parameters follow the keyword (*LIQ-REL*). The additional input data are cylindrical tank types (vertical or horizontal), tank diameter, length of the horizontal tank, puncture area, discharge coefficient, liquid density, initial liquid mass remaining in the tank and the initial gas pressure of the tank.

Keyword:

&-LIQ-RELease

Header:

Tank Type [-]	Tank Diameter [m]	Tank Length [m]	Puncture Area [m^2]	Discharge Coeff. [-]	Liquid Density [kg/m^3]	Initial Mass [kg]	Initial Pressure [Pa]

Example input:

1 2.0 6.0 0.0001 0.5 1.2 2.0 13000

Description:

Parameters	Description	Input Format	Default
Tank type	Vertical (1)/horizontal (2) tank	Integer 1or/2	1
Tank diameter	Diameter of the tank	Real	1.0
Tank length	Length of the tank	Real	1.0
Puncture area	Area of the releasing puncture	Real	0.0
Discharge coefficient	Discharge coefficient of a pollutant from a puncture	Real	0.8
Liquid density	Density of the liquid pollutant	Real	1.2
Initial mass	Initial liquid mass remaining in the tank	Real	1.0
Initial pressure	The initial gas pressure of in the tank	Real	0.0

5. Input Example

To make things somewhat clearer, this section uses an example based on a real experimental room with forced air ventilation which is shown in Figure 4. The measurements were performed by Castanet (1998) at INSA de Lyon, France.

The room was 3.1×3.1×2.5 m and modelled by 60 (4×3×5) sub-zones, three of which were flow element type. Supply air flow was 24 m3/h (1 air change per hour) and a pollutant source SF6 was a continuously injected tracer gas (at 2.943 mg/s) at the centre of room. The inputs to the simulation are the inside surface and inlet temperatures (Table 5).

Table 5 Input inside surface and inlet air temperatures (°C) (adapted from Castanet 1998).

Case	East	South	West	North	Floor	Ceiling	Inlet
A	20.0	18.9	19.9	20.0	19.4	21.0	33.5
B	21.5	22.2	21.6	21.6	21.4	21.7	22.3

The input file COwZ.CIF and output file COwZ.COF are given in appendices A and B.

6. References

Alamdari F. and Hammond G.P. (1983) Improved data correlations for buoyancy-driven convection in rooms. *Building Services Engineering Research and Technology*, **4** (3), 106-112.

Awbi H.B. and Hatton A. (2000) Mixed convection from heated room surfaces. *Energy and Buildings*, **32**, 153-166.

Castanet S. Contribution à l'étude de la ventilation et de la qualité de l'air intérieur des locaux. Ph.D. Thesis,1998, INSA de Lyon, France.

CIBSE (1988) *CIBSE Guilde*, 5th edition, Chartered Institute of Building Services Engineers, UK.

Dols W.S. (2001) A tool for modelling airflow & contaminant transport. *ASHRAE Journal*, **23**(3), 35-42.

Dorer V. and Weber A. (1995) *COMVEN Programmer's Guide*. Available from the authors (Viktor.dorer@empa.ch, last referenced May 2002).

Feustel H.E. and Smith B.V. (1997) *COMIS 3.0- User's Guide*. Available from the LawrenceBerkeley Laboratory, Berkeley, USA.

Feustel H.E. (1999) COMIS - An international multizone air-flow and contaminant transport model. *Energy and Buildings*, **30**, 3-18.

Fisher D.E. (1995) An experimental investigation of mixed convection convection heat transfer in a rectangular enclosure. PhD Thesis, University of Illinois, Urbana USA.

Khalifa A.J.N. and Marshall R.H. (1990) Validation of heat transfer coefficients on interior building surfaces using a real-sized indoor test cell. *Int. J. Heat Mass Transfer*, **33** (10), 2219-2236.

Ren Z. (2002) Enhanced modelling of indoor air flows, temperatures, pollutant emission and dispersion by nesting sub-zones within a multizone model. Unpublished PhD Thesis. The Queen's University of Belfast, September 2002.

Walton G.N. (1997) *CONTAM 96 users manual, NISTIR 6065*, National Institute of Standards and Technology, USA.

Appendix A

Input file for the ventilated room

```
# COwZ Input File (.CIF) --- Generated by z.ren for COwZ #
#
# Please send your remarks and questions to z.ren@qub.ac.uk
#======================================================================

&-CIF                     1
  ____________________
 |COwZ Input File    |
 |___________________|

COwZ.cif

&-PR-UNITS
  _________________________________
 |Unit Conversion Definitions      |
 |Name     Input             Output|
 |_________________________________|
concentration  kg/kg         mg/kg

# see COMIS.SET file in your simulation directory


&-PR-IDENtification       2
  _______________
 |1.|Problemname |
 |__|            |
 |_______________|



  _______________
 |2.|Versionname |
 |__|            |
 |_______________|

1.0

&-PR-SIMUlation options
  __________________________________________________________
 | Simulation Option Keywords:  One keyword per line        |
 | Keywords may be preceded by NO                           |
 |__________________________________________________________|
 | VENT:ilation              POL:utant        HEAT:flow     |
 | CONC:entrations           INPUT echo       DEFAULT echo  |
 | SET echo                  UNIT             SSPILL liquid|
 | MSPILL                    VOC coating      GAS release   |
 | LIQ (liquid release)                                     |
 |                                                          |
 | SCHED:time<time>                                         |
 | START:time [CONT|REUSE]                                  |
 | STOP:time [KEEP]                                         |
 |__________________________________________________________|


VENTILATION
POLUTANT
HEAT
```

```
STARTtime 20020611_00:00:00
STOPtime 20020612_00:00:00

&-PR-OUTPut options        3
   ______________________________________________________________
  | Output Option Keywords:  One keyword per line                 |
  |______________________________________________________________|
  | Keyword {Link/Zones}                                          |
  | Define data to be Stored (append -S for Storing each value): |
  | PZ {Zones} = Pressure/zone    FL {Links}  = Flow/link         |
  | TZ {Zones} = Temp./zone       TL {Links}  = Temp./link        |
  | MZ {Zones} = Moisture/zone    SL {Links}  = Status            |
  | FZ {Zones} = Flow/zone        HA          = Outdoor Humidity |
  | WA         = Velocity         TA          = Air Temp.         |
  | Cn {Zones} = Concentr.        Qn {Zones}  = Poll. Source      |
  | Sn {Zones} = Poll. Sink       PE {Points} = Wind Pressure     |
  |   for Gas n (1<= n <=5)       PT = Pressure of storage tank  |
  | GA = Source emission rate     PA = area of liquid pool        |
  | HZ = Humidity/zone                                            |
  | IZ = Infil/zone                                               |
  | AZ = ACH                                                      |
  | MZ = Age of air/zone                                          |
  | EZ = Ach index/zone                                           |
  |                                                               |
  | FB = Flow matrix/building                                     |
  | MB = Arithmetic men of building mean age of air               |
  | RB = RMS of building mean age of air                          |
  | NB = nominal time constant of building mean age of air        |
  | EB = ACH efficiency of building                               |
  | LB = Ventilation heat loss energy of building                 |
  | IB = Outdoor infil/building                                   |
  | AB = Outdoor ach/building                                     |
  |                                                               |
  | For mean values replace -S with -T                            |
  |______________________________________________________________|

PZ-S zone_40 zone_39 zone_38 zone_37 zone_36 zone_35 zone_34
#   zone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
#   zone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
#    zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
#    zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
PZ-T zone_40 zone_39 zone_38 zone_37 zone_36 zone_35 zone_34
#   zone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
#   zone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
#    zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
#    zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
TZ-S zone_40 zone_39 zone_38 zone_37 zone_36 zone_35 zone_34
#   zone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
#   zone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
#    zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
#    zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
TZ-T zone_40 zone_39 zone_38 zone_37 zone_36 zone_35 zone_34
TZ-Tzone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
TZ-Tzone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
TZ-T   zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
TZ-T   zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
#   zone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
#   zone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
#    zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
#    zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
FZ-T zone_40 zone_39 zone_38 zone_37 zone_36 zone_35 zone_34
```

```
#   zone_33 zone_32 zone_31 zone_30 zone_29 zone_28 zone_27 zone_26 zone_25
#   zone_24 zone_23 zone_22 zone_21 zone_20 zone_19 zone_18 zone_17 zone_16
#    zone_15 zone_14 zone_13 zone_12 zone_11 zone_10 zone_9 zone_8 zone_7
#    zone_6 zone_5 zone_4 zone_3 zone_2 zone_1
FL-S  hf_30  hf_29  hf_28  hf_27  hf_26  hf_25  hf_24  hf_1  hf_2  hf_3  hf_4  hf_5
hf_6
#   hf_23 hf_22 hf_21 hf_20 hf_19 hf_18 hf_17 hf_16 hf_15 hf_14 hf_13 hf_12
#    hf_11 hf_10 hf_9 hf_8 hf_7 vf_36 vf_35
#   vf_34 vf_33 vf_32 vf_31 vf_30 vf_29 vf_28 vf_27 vf_26 vf_25 vf_24 vf_23
#   vf_22 vf_21 vf_20 vf_19 vf_18 vf_17 vf_16 vf_15 vf_14 vf_13 vf_12 vf_11
#    vf_10 vf_9 vf_8 vf_7 vf_6 vf_5 vf_4 vf_3 vf_2 vf_1 bl_14 bl_13 bl_12
#    bl_11 bl_10 bl_9 bl_8 bl_7 bl_6 bl_5 bl_4 bl_3 bl_2 bl_1
FL-Thf_30 hf_29 hf_28 hf_27 hf_28 hf_25 hf_24 vf_36 vf_35 vf_34 vf_33 vf_32
#   hf_23 hf_22 hf_21 hf_20 hf_19 hf_18 hf_17 hf_16 hf_15 hf_14 hf_13 hf_12
#    hf_11  hf_10  hf_9  hf_8  hf_7  hf_6  hf_5  hf_4  hf_3  hf_2  hf_1  vf_31  vf_30
vf_29
#    vf-28 vf_27 vf_26 vf_25 vf_24 vf_23
#   vf_22 vf_21 vf_20 vf_19 vf_18 vf_17 vf_16 vf_15 vf_14 vf_13 vf_12 vf_11
#vf_10 vf_9 vf_8 vf_7 vf_6 vf_5 vf_4 vf_3 vf_2 vf_1 bl_20 bl_19 bl_18 bl_17
#    bl_14 bl_13 bl_12
#    bl_11 bl_10 bl_9 bl_8 bl_7 bl_6 bl_5 bl_4 bl_3 bl_2 bl_1


&-PR-CONTrol parameters    4                 --- OPTIONAL DATA SECTION ---
 _____________________________________________________________________
 |1.| Under |      T  o  l  e  r  a  n  c  e  s   |Start   |Link Flow   |
 |__| Relax-|____________________________________|Number  |Pressure    |
 |    ation | absolute    | Relative |CORR*JAC(i,i)|of Ite-|Laminar Flow|
 |    Factor|  EpsFA      |  EpsFR   | EpsCJ       |rations|DifLim      |
 |    [-]   |  [kg/s]     |  [-]     |  [kg/s]     |  [-]  |   [Pa]     |
 |__________|____________|__________|_____________|_______|____________|

        0.5      1.0e-6     1.0e-4       3.0e-11       1       1.0e-4

 ______________________________________________________________________
 |2.|   use old   |No Pressure   |Max Number of| Relative   | Max Number|
 |__|  Pressures  |Initialization|Iterations    | error for  |  of       |
 |                |              |allowed for   | thermal    | Iterations|
 |0=Zero          |0=Lin.initial.|thermal       |simulation  | allowed   |
 |  Pressures     |1=No initial. |simulation    |convergence| for air   |
 |1=use           |              |              |            | flow      |
 |  Previous      |              |              | EpsTR      |           |
 |                |              |              |            |           |
 | UseOPz         |NoInit        |  Nitt        |            |  Miter    |
 |     [-]        |     [-]      |  [-]         | [-]        |  [-]      |
 |________________|______________|______________|____________|___________|

                0            0      10000       1.0e-5     10000

&-NET-AIR flow components        5
# Allowed prefixes are: *CR  *FA *DS *DF *F1 *F2 *F3 *F4 *WI *TD
#                        |     |  |    |  |____________|   |  |
#                             crack |  duct |  flow-controllers |  testdata
points
#                              fan     duct-fitting        window(openable)
# keep the KEYWORDs &-CR,...,&-TD in this part &-NET-AIR
```

```
&-CR       CRACK                  6
 __________________________________________________________
|1.|   Cs      |Exp n    | Lenght   |   Wall Properties     |
|__|           |         |          | Thickness  | U-Value |
|   (kg/s@1Pa)|  (-)    |  [m]     |    [m]     |[W/m2 K] |
|______________|_________|__________|_____________|__________|
 _____________________________________________________________
|2.|Filter 1    | Filter 2 | Filter 3 | Filter 4 | Filter 5 |
|__|   (-)      |   [-]    |   [-]    |   [-]    |   [-]    |
|_______________|__________|__________|__________|__________|



&-FA       FAN             7
# line1= flag....  #line2=Pminimum....   #line3=C0.....
# line4 - line7=datapairs,last line is always the filter line
 ________________________________________________________________
|1.|# Flag: 1=use Polynomial C0,..C5                              |
|__|        2=use Data pairs to calculate C0,..Cni                |
| _______________________________________________________________|
| Flag|Exp Polynom.|RhoI     | NfI     |   Cm            | Exp n  |
|(-)  |(-)         |(kg/m3)  |[rpm]    |[kg/s@1Pa]       |[-]     |
|_____|____________|_________|_________|________________|________|

 ______________________________________________
|2.| Pmin    |  Pmax     |Slope      | Intercept |
|__| (Pa)    |  (Pa)     |(m3/s/Pa)  |(m3/s)     |
|__________|__________|__________|___________|

 ______________________________________________________________
|3.|C0      |C1        |C2        |     |C4        |C5        |
|__|(m3/s)  |[m3/s/Pa] |[../Pa2 ] |3  ] |[../Pa4 ] |[../Pa5]  |
|__________|__________|__________|_____|__________|__________|

 _________________________________________________________________________
|4.  |Fan Curve Pressure Rise vs FlowRate   maximum 4 Lines                |
|__  | Data Pairs    minimum 3 Pairs,    maximum 12 Pairs                  |
|(Pa)|       (m3/s)      |(Pa)        | (m3/s)       |(Pa)        |(m3/s)   |
|____|_________________|___________|____________|___________|__________|

 _____________________________________________________________
|8.|Filter 1    | Filter 2 | Filter 3 | Filter 4 | Filter 5 |
|__|   (-)      |    [-]   |    [-]   |    [-]   |    [-]   |
|_______________|__________|__________|__________|__________|
```

```
&-DS       DUCT Straight   8
 _______________________________________________________________________
|1.|  Ducts straight part                                   |    one Fitting      |
|__|________________________________________________________|_____________________|
| Diam1     |Diam2     |Rough       |Lduct     |Zeta      |Type|Param1 |Param2 |
|   (m)     |   (m)    |    (mm)    |    (m)   |    [-]   |[-] |[acc t]|[acc t]|
|___________|__________|____________|__________|__________|____|_______|_______|

 ____________________________
|2.| Specific Duct Leakage   |
|__|_________________________|
|     Cs            |  ExpN  |
| (kg/s/m2 @ 1Pa)   |  (-)   |
|___________________|________|

 ___________________________________________________________
|3.|Filter 1    | Filter 2 | Filter 3 | Filter 4 | Filter 5 |
|__|   (-)      |    [-]   |    [-]   |    [-]   |    [-]   |
|_______________|__________|__________|__________|__________|
```

```
&-DF       DUCT Fitting    9

#
#    Type   Name                  No of Param   Parameter  Description
#                                               Param1     Param2
#
#    1      Entry Round                 2          t/D        L/D
#    2         with Screen     1          Screen %  -
#    3      Hood                        2           Type    Angle
#           Round:                                   1
#           Rectangular                              2
#    4      Exit Round                  -          -          -
#    5         with Screen     1          Screen%   -
#    6      Elbow                       1          r/D        -
#    7      Diffusor Round              2         A1/A2     Angle
#    8      Contraction Round           2         A1/A2     Angle
#    9      Obstruction Round Duct
#                  Screen               1          Screen%    -
#    10     Perforated Plate            2        T/DP N*DP**2/DD**2
#    11     Orifice A                   1          A1/A2      -
#    12     DIN Orifice                 2          A1/A2      L
#    13     Damper                      1          Angle      -
 _________________________________________________
|1.|Type |Param1               |Param2               |
|__|[-]  |[according Type]     |[according Type]     |
|________|_____________________|_____________________|
```

```
&-F1       FLOWCONTROLLER IDEAL SYMMETRIC            10

 ________________________________________________________
|1.|#Range1                                               |
|__|______________________________________________________|
| Flowcontroller curve , Maximum 1 line (2 pairs)         |
|  Data pairs: Pression rise, Flowrate                    |
|     (Pa)     |     (m3/s)    |     (Pa)     |    (m3/s)    |
|______________|_______________|______________|______________|
 ____________________
|2.|   Fva_Setpoint  |
|__|   (m3/s)        |
|____________________|
```

```
  _________________________________________________________
 |3.|Filter 1    |Filter 2   |Filter 3   |Filter 4   |Filter 5   |
 |__|(m3/s)      |[m3/s]     |[m3/s]     |[m3/s]     |[m3/s]     |
 |_______________|___________|___________|___________|___________|
```

```
&-F2       FLOWCONTROLLER IDEAL NONSYMETRIC         11
  _______________________________________________________
 |1.|#Range1                                             |
 |__|____________________________________________________|
 | Flowcontroller curve , Maximum 1 line (2 pairs)       |
 |  Data pairs: Pression rise, Flowrate                  |
 |     (Pa)     |     (m3/s)   |     (Pa)     |    (m3/s)    |
 |______________|______________|______________|______________|

  _________________________________________
 |2.|#Range2                               |
 |__|______________________________________|
 |Fva_Setpoint | Fva_setpoint negative flow |
 |(m3/s)       | (m3/s)                     |
 |_____________|____________________________|

  _________________________________________________________
 |3.|Filter 1    |Filter 2   |Filter 3   |Filter 4   |Filter 5   |
 |__|(m3/s)      |[m3/s]     |[m3/s]     |[m3/s]     |[m3/s]     |
 |_______________|___________|___________|___________|___________|
```

```
&-WI       WINDOW / DOOR                            14
  _____________________________________________________________
 |1.|Closed: Cs     | Expn|LVO Type   |Lwmax     |Lhmax     |Type1: |
 |__|               |     |1=rectang  |          |          |Lextra |
 |                  |     |2=horizon. |          |          |Type2: |
 |                  |     |pivoting   |          |          |Axis-  |
 |                  |     |axis       |          |          | height|
 |   [kg/s@1Pa]     |[-]  |[-]        |[m]       |[m]       | [-]   |
 |__________________|_____|___________|__________|__________|_______|

  ________________________________________
 |2.|Type1:         |CD |Width |Height|Start |
 |__| opening       |   |Factor|Factor|Height|
 |     factor       |   |      |      |Factor|
 |Type2:            |   |      |      |      |
 |  opening angle   |   |      |      |      |
 |  factor          |   |      |      |      |
 |   [-]            |[-]|  [-] | [-]  | [-]  |
 |__________________|___|______|______|______|

  _________________________________________________________
 |3.|Filter 1    |Filter 2   |Filter 3   |Filter 4   |Filter 5   |
 |__|   (-)      |   [-]     |   [-]     |   [-]     |   [-]     |
 |_______________|___________|___________|___________|___________|
```

```
&-TD       TEST DATA COMPONENT(LOG-LOG inter-extrapolation) 15

  _______________________________
 |1.|Flag Fva or Fma | RhoI       |
 |__|     (1 or   2) |[kg/m3]     |
 |___________________|___________|
```

```
 ____________________________________________________________________________
|2.| Pressure and Flowrate               maximum  6 Lines                    |
|__| Data Pairs     minimum 3 Pairs ,    maximum 18 Pairs                    |
| (Pa)        | (m3/s)     | (Pa)       | (m3/s)     | (Pa)       | (m3/s)     |
|_____________|____________|____________|____________|____________|____________|

 ___________________________________________________________
|3.|Filter 1    |Filter 2   |Filter 3   |Filter 4   |Filter 5   |
|__|   (-)      |   [-]     |   [-]     |   [-]     |   [-]     |
|_______________|___________|___________|___________|___________|

&-JE      HORIZONTAL JET          58
 _____________________________________________________
| II| Cd  | Alfa | zm0    | b0  | xl  |u0   |dT0|A0  |
|   | (-) | (-)  |(kg/s)  | (m) | (m) |(m/s)|(K)|(m2)|
|___|_____|______|________|_____|_____|_____|___|____|

*JEje_1
  1   -1.0      0.5   0.00832     1.0   1.0
*JEje_2
  1   0.250852  0.5   0.00832     0.2   0.45
*JEje_3
  1   0.250852  0.5   0.00832     0.2   0.9
*JEje_4
  1   0.250852   0.5   0.00832    0.2   2.0

&-WL       THERMAL BOUNDARY LAYER  59
 ______________________________________
|Height|Depth|Width|Cd   | Tw    | zl  |
| (m)  | (m) | (m) |(-)  | (K)   | (m) |
|______|_____|_____|_____|_______|_____|



&-WP       THERMAL PLUME  60
 ___________________________________________________
|Height|Depth|Width|Cd   | Beta | Hsf  |Z0   | Zl  |
| (m)  | (m) | (m) |(-)  | (-)  | (w)  |(m)  | (m) |
|______|_____|_____|_____|______|______|_____|_____|


&-HF       HORIZONTAL FLOW        61
 _________________________
|Height |Width  |  Cd     |
| (m)   | (m)   |  (-)    |
|_______|_______|_________|

*HFhf_1
    0.5   1.0      0.83
*HFhf_2
    0.5   1.0      0.83
*HFhf_3
    0.5   1.0      0.83
*HFhf_4
    0.5   1.1      0.83
*HFhf_5
    0.5   1.1      0.83
*HFhf_6
    0.5   1.1      0.83
```

```
*HFhf_7
    0.5   1.0       0.83
*HFhf_8
    0.5   1.0       0.83
*HFhf_9
    0.5   1.0       0.83

*HFhf_10
    0.5   1.0       0.83
*HFhf_11
    0.5   1.0       0.83
*HFhf_12
    0.5   1.0       0.83
*HFhf_13
    0.5   1.1       0.83
*HFhf_14
    0.5   1.1       0.83
*HFhf_15
    0.5   1.1       0.83
*HFhf_16
    0.5   1.0       0.83
*HFhf_17
    0.5   1.0       0.83
*HFhf_18
    0.5   1.0       0.83

*HFhf_19
    0.5   1.0       0.83
*HFhf_20
    0.5   1.0       0.83
*HFhf_21
    0.5   1.0       0.83
*HFhf_22
    0.5   1.1       0.83
*HFhf_23
    0.5   1.1       0.83
*HFhf_24
    0.5   1.1       0.83
*HFhf_25
    0.5   1.0       0.83
*HFhf_26
    0.5   1.0       0.83
*HFhf_27
    0.5   1.0       0.83

*HFhf_28
    0.5   1.0       0.83
*HFhf_29
    0.5   1.0       0.83
*HFhf_30
    0.5   1.0       0.83
*HFhf_31
    0.5   1.1       0.83
*HFhf_32
    0.5   1.1       0.83
*HFhf_33
    0.5   1.1       0.83
*HFhf_34
    0.5   1.0       0.83
*HFhf_35
    0.5   1.0       0.83
```

```
*HFhf_36
    0.5   1.0      0.83

*HFhf_37
    0.5   1.0      0.83
*HFhf_38
    0.5   1.0      0.83
*HFhf_39
    0.5   1.0      0.83
*HFhf_40
  0.483587272   1.1      0.83
*HFhf_41
  0.467174545   1.1      0.83
*HFhf_42
  0.427054545   1.1      0.83
*HFhf_43
    0.5   1.0      0.83
*HFhf_44
    0.5   1.0      0.83
*HFhf_45
    0.5   1.0      0.83

*HFhf_46
    0.5   0.45      0.83
*HFhf_47
    0.5   0.45      0.83
*HFhf_48
    0.5   1.1      0.83
*HFhf_49
    0.5   1.1      0.83
*HFhf_50
    0.5   0.45      0.83
*HFhf_51
    0.5   0.45      0.83
*HFhf_52
    0.5   1.1       0.83
*HFhf_53
    0.5   1.1       0.83

*HFhf_54
    0.5   0.45      0.83
*HFhf_55
    0.5   0.45      0.83
*HFhf_56
    0.5   1.1      0.83
*HFhf_57
    0.5   1.1      0.83
*HFhf_58
    0.5   0.45      0.83
*HFhf_59
    0.5   0.45      0.83
*HFhf_60
    0.5   1.1       0.83
*HFhf_61
    0.5   1.1       0.83

*HFhf_62
    0.5   0.45      0.83
*HFhf_63
    0.5   0.45      0.83
*HFhf_64
```

```
    0.5   1.1      0.83
*HFhf_65
    0.5   1.1      0.83
*HFhf_66
    0.5   0.45      0.83
*HFhf_67
    0.5   0.45      0.83
*HFhf_68
    0.5   1.1      0.83
*HFhf_69
    0.5   1.1      0.83

*HFhf_70
    0.5   0.45      0.83
*HFhf_71
    0.5   0.45      0.83
*HFhf_72
    0.5   1.1      0.83
*HFhf_73
    0.5   1.1      0.83
*HFhf_74
    0.5   0.45      0.83
*HFhf_75
    0.5   0.45      0.83
*HFhf_76
    0.5   1.1      0.83
*HFhf_77
    0.5   1.1      0.83

*HFhf_78
    0.5   0.45      0.83
*HFhf_79
    0.5   0.45      0.83
*HFhf_80
    0.5   1.1      0.83
*HFhf_81
    0.5   1.1      0.83
*HFhf_82
    0.5   0.45      0.83
*HFhf_83
    0.5   0.45      0.83
*HFhf_84
    0.5   1.1      0.83
*HFhf_85
    0.5   1.1      0.83

*HFhf_86
    0.1   0.2      0.83


&-VF       VERTICAL FLOW      62
   _____________________________________
  |Height |Depth |Width |Cd  |Hi    |Hj  |
  | (m)   | (m)  | (m)  |(-) |(m)   |(m) |
  |_______|______|______|____|______|____|

*VFvf_1
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_2
   0.5   1.0   0.45    0.83   0.5  0.5
```

```
*VFvf_3
   0.5   1.0   1.1    0.83   0.5  0.5
*VFvf_4
   0.5   1.0   1.1    0.83   0.5  0.5
*VFvf_5
   0.5   1.1   0.45    0.83  0.5  0.5
*VFvf_6
   0.5   1.1   0.45    0.83   0.5  0.5
*VFvf_7
   0.5   1.1   1.1    0.83   0.5  0.5
*VFvf_8
   0.5   1.1   1.1    0.83   0.5  0.5
*VFvf_9
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_10
   0.5   1.0   0.45    0.83   0.5  0.5
*VFvf_11
   0.5   1.0   1.1    0.83   0.5  0.5
*VFvf_12
   0.5   1.0   1.1    0.83   0.5  0.5

*VFvf_13
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_14
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_15
   0.5   1.0   1.1    0.83    0.5 0.5
*VFvf_16
   0.5   1.0   1.1    0.83    0.5  0.5
*VFvf_17
   0.5   1.1   0.45    0.83  0.5  0.5
*VFvf_18
   0.5   1.1   0.45    0.83  0.5  0.5
*VFvf_19
   0.5   1.1   1.1    0.83    0.5 0.5
*VFvf_20
   0.5   1.1   1.1    0.83    0.5  0.5
*VFvf_21
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_22
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_23
   0.5   1.0   1.1    0.83    0.5 0.5
*VFvf_24
   0.5   1.0   1.1    0.83    0.5  0.5

*VFvf_25
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_26
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_27
   0.5   1.0   1.1    0.83    0.5 0.5
*VFvf_28
   0.5   1.0   1.1    0.83    0.5  0.5
*VFvf_29
   0.5   1.1   0.45    0.83  0.5  0.5
*VFvf_30
   0.5   1.1   0.45    0.83  0.5  0.5
*VFvf_31
   0.5   1.1   1.1    0.83    0.5 0.5
*VFvf_32
```

```
   0.5   1.1   1.1    0.83    0.5  0.5
*VFvf_33
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_34
   0.5   1.0   0.45    0.83  0.5  0.5
*VFvf_35
   0.5   1.0   1.1    0.83    0.5 0.5
*VFvf_36
   0.5   1.0   1.1    0.83    0.5  0.5

*VFvf_37
   0.5   1.0   0.45    0.83   0.5  0.5
*VFvf_38
   0.5   1.0   0.45    0.83   0.5  0.5
*VFvf_39
   0.5   1.0   1.1    0.83    0.5  0.5
*VFvf_40
   0.5   1.0   1.1    0.83    0.5  0.5
*VFvf_41
   0.5   1.1   0.45    0.83    0.5  0.5
*VFvf_42
   0.5   1.1   0.45    0.83   0.5  0.5
*VFvf_43
   0.5   1.1   1.1    0.83    0.5  0.5
*VFvf_44
   0.5   1.1   1.1    0.83   0.5  0.5

*VFvf_45
   0.5   1.0   0.45    0.83   0.5  0.5
*VFvf_46
   0.5   1.0   0.45    0.83   0.5  0.5
*VFvf_47
   0.5   1.0   1.1    0.83    0.5  0.5
*VFvf_48
   0.5   1.0   1.1    0.83    0.5  0.5

&-BL   BALANCE WITH LAYER             63
  ____________________________________________
 |Height |Depth |Width |Cd  |Tw     |zl1 |zl2 |
 |  (m)  |  (m) |  (m) |(-) |  (K)  |(m) |(m) |
 |_______|______|______|____|_______|____|____|



&-TRANSITion                         16         --- OPTIONAL DATASECTION ---
  _______________
 |ReLam  |ReTurb |
 |(-)    |(-)    |
 |_______|_______|

     2300    3500

&-NET-HVAc                           17         --- OPTIONAL DATASECTION ---
```

```
&-NET-ZONes                      18
  ________________________________________________________________
 |Zone| Name     | Temp |Ref.   |Vol   |Abs.    | A01 |A02  |Heat  |
 | ID |          |      | Height|[m3]  | Hum    |     |     |source|
 | [-]|          |      |       |H/D/W |        |     |     | Hps  |
 |__  |          | [oC] |  [m]  | [m]  |[g/kg]  |[m2] |[m2] |[W]   |
 |1 | |          |      |       |      |        |     |     |      |
 |__|_|__________|______|_______|______|________|_____|_____|______|

  __________________________________________________________
 |IZR| ZTE |ZTS     |ZTW     |ZTN     |ZTC     |ZTF     |Schedue |
 |[-]|[-]  |[-]     |[-]     |[-]     |[-]     |[-]     |names   |
 |__ |     |        |        |        |        |        |        |
 | 2||     |        |        |        |        |        |[T./H./ |
 |__||_____|________|________|________|________|________|________|

zone_1         zone_1       20      0.0 0.5/1.0/0.45    0  0 0 0
1    1.0    1.0    0    0    0   1.0
zone_2         zone_2       20      0.0 0.5/1.0/0.45    0 0 0 0
1    1.0    0    0    0    0   1.0
zone_3         zone_3       20      0.0 0.5/1.0/1.1    0  0 0 0
1    1.0    0    0    0    0    1.0
zone_4         zone_4       20      0.0 0.5/1.0/1.1    0   0 0 0
1    1.0    0    0   1.0   0    1.0
zone_5         zone_5       20     0.0 0.5/1.1/0.45    0  0  0  0
1    0   1.0    0    0    0     1.0
zone_6         zone_6       20      0.0 0.5/1.1/0.45       0  0 0 0
1    0    0     0    0   0     1.0
zone_7         zone_7       20      0.0 0.5/1.1/1.1       0   0.0  0  0
1    0    0    0    0   0     1.0
zone_8         zone_8       20      0.0 0.5/1.1/1.1       0  0  0   0
1    0    0    0    1.0   0     1.0
zone_9         zone_9       20      0.0 0.5/1.0/0.45       0   0   0   0
1     0   1.0    1.0     0    0    1.0
zone_10        zone_10       20    0.0 0.5/1.0/0.45      0    0  0   0
1    0    0     1.0    0    0    1.0
zone_11        zone_11       20    0.0 0.5/1.0/1.1       0   0   0  0
1     0    0    1.0    0    0    1.0
zone_12        zone_12       20    0.0 0.5/1.0/1.1       0    0  0   0
1     0    0    1.0     1.0    0    1.0

zone_13        zone_13       20     0.0 0.5/1.0/0.45       0  0  0   0
1     1.0     1.0     0    0    0   0
zone_14        zone_14       20     0.0 0.5/1.0/0.45       0   0  0  0
1     1.0     0    0   0     0     0
zone_15        zone_15       20     0.0 0.5/1.0/1.1       0    0  0   0
1     1.0    0     0   0     0     0
zone_16        zone_16       20     0.0 0.5/1.0/1.1       0    0   0  0
1     1.0    0     0    1.0    0    0
zone_17        zone_17       20     0.0 0.5/1.1/0.45       0   0  0  0
1     0    1.0    0     0    0    0
zone_18         zone_18       20     0.0 0.5/1.1/0.45    0  0  0   0
1     0    0     0    0    0   0
zone_19         zone_19       20     0.0 0.5/1.1/1.1    0   0   0   0
1     0    0    0  0     0    0
zone_20         zone_20       20     0.0 0.5/1.1/1.1    0   0   0   0
1     0     0    0   1.0    0   0
zone_21         zone_21       20     0.0 0.5/1.0/0.45    0   0   0   0
1    0    1.0    1.0   0     0    0
zone_22        zone_22       20     0.0 0.5/1.0/0.45       0   0  0   0
1    0    0    1.0    0    0    0
```

```
zone_23         zone_23        20      0.0 0.5/1.0/1.1        0   0   0   0
1    0    0    1.0      0    0    0
zone_24         zone_24        20      0.0 0.5/1.0/1.1        0   0   0   0
1    0    0    1.0      1.0    0    0

zone_25         zone_25        20      0.0 0.5/1.0/0.45        0   0   0   0
1    1.0    1.0     0    0    0    0
zone_26         zone_26        20      0.0 0.5/1.0/0.45        0    0   0   0
1    1.0    0    0    0    0    0
zone_27         zone_27        20      0.0 0.5/1.0/1.1        0    0    0   0
1    1.0    0    0    0    0    0
zone_28         zone_28        20      0.0 0.5/1.0/1.1        0    0    0   0
1     1.0    0    0    1.0    0    0
zone_29         zone_29        20      0.0 0.5/1.1/0.45        0   0   0   0
1    0    1.0    0    0    0    0
zone_30          zone_30        20      0.0 0.5/1.1/0.45    0   0   0   0
1    0    0    0    0    0    0
zone_31          zone_31        20      0.0 0.5/1.1/1.1    0    0   0   0
1    0    0    0    0    0    0
zone_32          zone_32        20      0.0 0.5/1.1/1.1    0     0   0  0
1    0   0   0   1.0    0    0
zone_33          zone_33        20      0.0 0.5/1.0/0.45   0   0   0   0
1    0    1.0   1.0    0    0  0
zone_34         zone_34        20      0.0 0.5/1.0/0.45        0   0   0   0
1    0    0    1.0   0    0   0
zone_35         zone_35        20      0.0 0.5/1.0/1.1        0    0   0   0
1    0    0    1.0   0    0   0
zone_36         zone_36        20      0.0 0.5/1.0/1.1        0    0    0   0
1    0    0    1.0    1.0    0    0

zone_37         zone_37        20      0.0 0.5/1.0/0.45        0    0    0   0
1    1.0     1.0    0  0    0    0
zone_38         zone_38        20      0.0 0.5/1.0/0.45        0     0   0   0
1    1.0     0    0   0    0   0
zone_39         zone_39        20      0.0 0.5/1.0/1.1        0     0   0   0
1     1.0    0    0    0    0    0
zone_40         zone_40        20      0.0 0.5/1.0/1.1        0     0   0   0
1     1.0    0    0    1.0    0    0
zone_41         zone_41        20      0.0 0.5/1.1/0.45      0    0   0    0
1    0    1.0     0    0    0   0
zone_42          zone_42        20      0.0 0.5/1.1/0.45    0   0    0   0
1   0.0     0.0    0.0    0.0    0.0   0.0
zone_43          zone_43        20      0.0 0.5/1.1/1.1    0    0   0   0
1    0.0    0.0    0.0    0.0    0.0    0.0
zone_44          zone_44        20      0.0 0.5/1.1/1.1    0    0   0   0
1    0    0    0    1.0    0    0
zone_45          zone_45        20      0.0 0.5/1.0/0.45    0    0    0   0
1    0    1.0    1.0    0    0    0
zone_46         zone_46        20      0.0 0.5/1.0/0.45        0    0   0   0
1     0    0    1.0    0    0    0
zone_47         zone_47        20      0.0 0.5/1.0/1.1        0   0   0    0
1     0    0    1.0    0    0    0
zone_48         zone_48        20      0.0 0.5/1.0/1.1        0    0   0    0
1    0    0     1.0    1.0    0    0

zone_49         zone_49        20      0.0 0.5/1.0/0.45        0    0   0    0
1    1.0     1.0     0    0    1.0     0
zone_50         zone_50        20      0.0 0.5/1.0/0.45        0    0    0   0
1    1.0     0     0    0    1.0     0
zone_51         zone_51        20      0.0 0.5/1.0/1.1        0     0    0   0
1    1.0     0     0    0    1.0     0
```

```
zone_52        zone_52       20     0.0 0.5/1.0/1.1       0      0   0    0
1    1.0     0    0    1.0    1.0    0
zone_53        zone_53       20     0.0 0.5/1.1/0.45       0    0    0   0
1    0    1.0    0    0     1.0    0
zone_54         zone_54       20     0.0 0.5/1.1/0.45    0   0   0    0
1    0    0    0    0     1.0    0
zone_55         zone_55       20     0.0 0.5/1.1/1.1    0    0   0   0
1     0    0    0    0     1.0   0
zone_56         zone_56       20     0.0 0.5/1.1/1.1    0     0   0   0
1    0    0    0    1.0    1.0     0
zone_57         zone_57       20     0.0 0.5/1.0/0.45    0     0   0   0
1    0   1.0    1.0     0    1.0    0
zone_58        zone_58       20     0.0 0.5/1.0/0.45       0    0  0   0
1    0    0    1.0    0    1.0    0
zone_59        zone_59       20     0.0 0.5/1.0/1.1       0     0   0   0
1    0    0    1.0    0    1.0    0
zone_60        zone_60       20     0.0 0.5/1.0/1.1       0     0    0   0
1    0    0    1.0    1.0     1.0   0


&-NET-ZL zone-layers             19        --- OPTIONAL DATASECTION ---

  ___________________________________________________________________
 |Zone|Start | Temp | Hum.  | Poll.|Volume|Source|Sink |Flow To|Flow To|
 |*ID |Height| Grad | Grad  | Grad |Fract.|Fract |Fract|Next LY|Zone   |
 |    |      |      |Factor|Factor|      |      |     |Factor |Factor |
 |(-) |(m)   |[oC/m]| [-]  | [-]  | [-]  | [-]  |[-]  | [-]   | [-]   |
 |____|______|______|______|______|______|______|_____|_______|_______|


&-NET-ZP zone-pollutants         20        --- OPTIONAL DATASECTION ---
  ______________________________
 |Zone |              Pollutant |
 |     |________________________|
 | *ID | Initial| Source |Sink  |
 |     | Concen.|        |      |
 | (-) | (kg/kg)| [kg/s] |[kg/s]|
 |_____|________|________|______|

*zone_31  0.0    2.943e-6       0.0



&-NET-EXTernal node data         21        --- OPTIONAL DATASECTION ---
  ____________________________________________________________
 |External Node No    | Facade Elem No    | Outside Conc Factor|
 |           (-)      |   (-)             | [-]                |
 |____________________|___________________|____________________|


&-NET-ZT zone-thermal-properties            --- OPTIONAL DATASECTION ---
  _______________________________________________________________
 |Zone     | Conductivity | Density | Capacity   | Wall Thickness |
 | *ID     |              |         |            |                |
 | [-]     | [W/mK]       | [kg/m3] | [kJ/kg/K]  | [m]            |
 |_________|______________|_________|____________|________________|
```

```
&-NET-ZF   flow element zone        65

  __________________
 |Zone     |Pressure |
 | *ID     |         |
 |  [-]    |[Pa]     |
 |________|_________|


&-WHEAT     room thermal description    66
  ____________________________________________________
 |Nzr|Hr |Dr |Wr |RTE  |RTS  |RTW  |RTN  |RTC  |RTF  |
 |   |   |   |   |     |     |     |     |     |     |
 |[-]|[m]|[m]|[m]| [-] |[-]  |[-]  |[-]  |[-]  |[-]  |
 |___|___|___|___|_____|_____|_____|_____|_____|_____|

   1    2.5  3.1  3.1  2    2    2    2    2     2

  ______________________________________________________
 |TWE  |TWS  |TWW  |TWN  |TWC  |TWF  |Rach |Uop  |Widz |
 |     |     |     |     |     |     |     |     |     |
 | [C] |[C]  |[C]  |[C]  |[C]  |[C]  |[h-1]|[m/s]| [m] |
 |_____|_____|_____|_____|_____|_____|_____|_____|_____|

  20.0    18.9   19.9   20.0  21.0   19.4   1.0


&-NET-LINks                      22
  _____________________________________ _________________________________
 |Link|Type | Zone No |  Height  | Own  |Act.|3Dflow|Schedule Name(5char.)|
 |    |     |_________|_________|      |    |  or  |_____________________|
 |    |     |    |    |    |    |      |    |      |T-Junct.  Ref.Link   |
 | No |Name |From|To  |From|To  |Height|Val.|Press |  No     |   Angle   |
 |(-) |(-)  |(-) |(-) |[m] |[m] | [m]  |[-] | [Pa] |  [-]    |   [deg]   |
 |____|_____|____|____|____|____|______|____|______|_________|___________|

hf_1     HFhf_1       zone_1 zone_2  0.0  0.0    0.0  1.0    0.0
hf_2     HFhf_2       zone_2 zone_3  0.0  0.0    0.0  1.0    0.0
hf_3     HFhf_3       zone_3 zone_4  0.0  0.0    0.0  1.0    0.0
hf_4     HFhf_4       zone_5 zone_6  0.0  0.0    0.0  1.0    0.0
hf_5     HFhf_5       zone_6 zone_7  0.0  0.0    0.0  1.0    0.0
hf_6     HFhf_6       zone_7 zone_8  0.0  0.0    0.0  1.0    0.0
hf_7     HFhf_7       zone_9 zone_10  0.0  0.0    0.0  1.0    0.0
hf_8     HFhf_8       zone_10 zone_11  0.0  0.0    0.0  1.0    0.0
hf_9     HFhf_9       zone_11 zone_12  0.0  0.0    0.0  1.0    0.0

hf_10    HFhf_10      zone_13 zone_14  0.0  0.0    0.0  1.0    0.0
hf_11    HFhf_11      zone_14 zone_15  0.0  0.0    0.0  1.0    0.0
hf_12    HFhf_12      zone_15 zone_16  0.0  0.0    0.0  1.0    0.0
hf_13    HFhf_13      zone_17 zone_18  0.0  0.0    0.0  1.0    0.0
hf_14    HFhf_14      zone_18 zone_19  0.0  0.0    0.0  1.0    0.0
hf_15    HFhf_15      zone_19 zone_20  0.0  0.0    0.0  1.0    0.0
hf_16    HFhf_16      zone_21 zone_22  0.0  0.0    0.0  1.0    0.0
hf_17    HFhf_17      zone_22 zone_23  0.0  0.0    0.0  1.0    0.0
hf_18    HFhf_18      zone_23 zone_24  0.0  0.0    0.0  1.0    0.0

hf_19    HFhf_19      zone_25 zone_26  0.0  0.0    0.0  1.0    0.0
```

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hf_20    HFhf_20      zone_26 zone_27  0.0  0.0    0.0  1.0    0.0
hf_21    HFhf_21      zone_27 zone_28  0.0  0.0    0.0  1.0    0.0
hf_22    HFhf_22      zone_29 zone_30  0.0  0.0    0.0  1.0    0.0
hf_23    HFhf_23      zone_30 zone_31  0.0  0.0    0.0  1.0    0.0
hf_24    HFhf_24      zone_31 zone_32  0.0  0.0    0.0  1.0    0.0
hf_25    HFhf_25      zone_33 zone_34  0.0  0.0    0.0  1.0    0.0
hf_26    HFhf_26      zone_34 zone_35  0.0  0.0    0.0  1.0    0.0
hf_27    HFhf_27      zone_35 zone_36  0.0  0.0    0.0  1.0    0.0

hf_28    HFhf_28      zone_37 zone_38  0.0  0.0    0.0  1.0    0.0
hf_29    HFhf_29      zone_38 zone_39  0.0  0.0    0.0  1.0    0.0
hf_30    HFhf_30      zone_39 zone_40  0.0  0.0    0.0  1.0    0.0
hf_31    HFhf_31      zone_41 zone_42  0.0  0.0    0.0  1.0    0.0
hf_32    HFhf_32      zone_42 zone_43  0.0  0.0    0.0  1.0    0.0
hf_33     HFhf_33       zone_43 zone_44  0.0  0.0    0.0  1.0    0.0
hf_34     HFhf_34       zone_45 zone_46  0.0  0.0    0.0  1.0    0.0
hf_35     HFhf_35       zone_46 zone_47  0.0  0.0    0.0  1.0    0.0
hf_36     HFhf_36       zone_47 zone_48  0.0  0.0    0.0  1.0    0.0

hf_37     HFhf_37       zone_49 zone_50  0.0  0.0    0.0  1.0    0.0
hf_38     HFhf_38       zone_50 zone_51  0.0  0.0    0.0  1.0    0.0
hf_39     HFhf_39       zone_51 zone_52  0.0  0.0    0.0  1.0    0.0
hf_40     HFhf_40       zone_53 zone_54  0.0  0.0    0.0  1.0    0.0
hf_41     HFhf_41       zone_54 zone_55  0.0  0.0    0.0  1.0    0.0
hf_42    HFhf_42      zone_55 zone_56  0.0  0.0    0.0  1.0    0.0
hf_43    HFhf_43      zone_57 zone_58  0.0  0.0    0.0  1.0    0.0
hf_44    HFhf_44      zone_58 zone_59  0.0  0.0    0.0  1.0    0.0
hf_45    HFhf_45      zone_59 zone_60  0.0  0.0    0.0  1.0    0.0

hf_46     HFhf_46       zone_1 zone_5  0.0  0.0    0.0  1.0    0.0
hf_47     HFhf_47       zone_2 zone_6  0.0  0.0    0.0  1.0    0.0
hf_48     HFhf_48       zone_3 zone_7  0.0  0.0    0.0  1.0    0.0
hf_49     HFhf_49       zone_4 zone_8  0.0  0.0    0.0  1.0    0.0
hf_50     HFhf_50       zone_5 zone_9  0.0  0.0    0.0  1.0    0.0
hf_51    HFhf_51      zone_6 zone_10  0.0  0.0    0.0  1.0    0.0
hf_52    HFhf_52      zone_7 zone_11  0.0  0.0    0.0  1.0    0.0
hf_53    HFhf_53      zone_8 zone_12  0.0  0.0    0.0  1.0    0.0

hf_54    HFhf_54      zone_13 zone_17  0.0  0.0    0.0  1.0    0.0
hf_55    HFhf_55      zone_14 zone_18  0.0  0.0    0.0  1.0    0.0
hf_56    HFhf_56      zone_15 zone_19  0.0  0.0    0.0  1.0    0.0
hf_57    HFhf_57      zone_16 zone_20  0.0  0.0    0.0  1.0    0.0
hf_58    HFhf_58      zone_17 zone_21  0.0  0.0    0.0  1.0    0.0
hf_59    HFhf_59      zone_18 zone_22  0.0  0.0    0.0  1.0    0.0
hf_60    HFhf_60      zone_19 zone_23  0.0  0.0    0.0  1.0    0.0
hf_61    HFhf_61      zone_20 zone_24  0.0  0.0    0.0  1.0    0.0

hf_62    HFhf_62      zone_25 zone_29  0.0  0.0    0.0  1.0    0.0
hf_63    HFhf_63      zone_26 zone_30  0.0  0.0    0.0  1.0    0.0
hf_64    HFhf_64      zone_27 zone_31  0.0  0.0    0.0  1.0    0.0
hf_65    HFhf_65      zone_28 zone_32  0.0  0.0    0.0  1.0    0.0
hf_66    HFhf_66      zone_29 zone_33  0.0  0.0    0.0  1.0    0.0
hf_67    HFhf_67      zone_30 zone_34  0.0  0.0    0.0  1.0    0.0
hf_68    HFhf_68      zone_31 zone_35  0.0  0.0    0.0  1.0    0.0
hf_69    HFhf_69      zone_32 zone_36  0.0  0.0    0.0  1.0    0.0

hf_70    HFhf_70      zone_37 zone_41  0.0  0.0    0.0  1.0    0.0
hf_71    HFhf_71      zone_38 zone_42  0.0  0.0    0.0  1.0    0.0
hf_72    HFhf_72      zone_39 zone_43  0.0  0.0    0.0  1.0    0.0
hf_73    HFhf_73      zone_40 zone_44  0.0  0.0    0.0  1.0    0.0
hf_74     HFhf_74       zone_41 zone_45  0.0  0.0    0.0  1.0    0.0
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hf_75     HFhf_75       zone_42 zone_46  0.0  0.0    0.0  1.0    0.0
hf_76     HFhf_76       zone_43 zone_47  0.0  0.0    0.0  1.0    0.0
hf_77     HFhf_77       zone_44 zone_48  0.0  0.0    0.0  1.0    0.0

hf_78     HFhf_78       zone_49 zone_53  0.0  0.0    0.0  1.0    0.0
hf_79     HFhf_79       zone_50 zone_54  0.0  0.0    0.0  1.0    0.0
hf_80     HFhf_80       zone_51 zone_55  0.0  0.0    0.0  1.0    0.0
hf_81     HFhf_81       zone_52 zone_56  0.0  0.0    0.0  1.0    0.0
hf_82     HFhf_82       zone_53 zone_57  0.0  0.0    0.0  1.0    0.0
hf_83     HFhf_83       zone_54 zone_58  0.0  0.0    0.0  1.0    0.0
hf_84     HFhf_84       zone_55 zone_59  0.0  0.0    0.0  1.0    0.0
hf_85     HFhf_85       zone_56 zone_60  0.0  0.0    0.0  1.0    0.0

hf_86     HFhf_86       zone_56 0Pa  0.0  0.0    0.0  1.0    0.0

vf_1      VFvf_1        zone_1  zone_13  0.0  0.0    0.0  1.0    0.0
vf_2      VFvf_2        zone_2  zone_14  0.0  0.0    0.0  1.0    0.0
vf_3      VFvf_3        zone_3  zone_15  0.0  0.0    0.0  1.0    0.0
vf_4      VFvf_4        zone_4  zone_16  0.0  0.0    0.0  1.0    0.0
vf_5      VFvf_5        zone_5  zone_17  0.0  0.0    0.0  1.0    0.0
vf_6      VFvf_6        zone_6  zone_18  0.0  0.0    0.0  1.0    0.0
vf_7      VFvf_7        zone_7  zone_19  0.0  0.0    0.0  1.0    0.0
vf_8      VFvf_8        zone_8  zone_20  0.0  0.0    0.0  1.0    0.0
vf_9      VFvf_9        zone_9  zone_21  0.0  0.0    0.0  1.0    0.0
vf_10     VFvf_10       zone_10 zone_22  0.0  0.0    0.0  1.0    0.0
vf_11     VFvf_11       zone_11 zone_23  0.0  0.0    0.0  1.0    0.0
vf_12     VFvf_12       zone_12 zone_24  0.0  0.0    0.0  1.0    0.0

vf_13     VFvf_13       zone_13 zone_25  0.0  0.0    0.0  1.0    0.0
vf_14     VFvf_14       zone_14 zone_26  0.0  0.0    0.0  1.0    0.0
vf_15     VFvf_15       zone_15 zone_27  0.0  0.0    0.0  1.0    0.0
vf_16     VFvf_16       zone_16 zone_28  0.0  0.0    0.0  1.0    0.0
vf_17     VFvf_17       zone_17 zone_29  0.0  0.0    0.0  1.0    0.0
vf_18     VFvf_18       zone_18 zone_30  0.0  0.0    0.0  1.0    0.0
vf_19     VFvf_19       zone_19 zone_31  0.0  0.0    0.0  1.0    0.0
vf_20     VFvf_20       zone_20 zone_32  0.0  0.0    0.0  1.0    0.0
vf_21     VFvf_21       zone_21 zone_33  0.0  0.0    0.0  1.0    0.0
vf_22     VFvf_22       zone_22 zone_34  0.0  0.0    0.0  1.0    0.0
vf_23     VFvf_23       zone_23 zone_35 0.0  0.0    0.0  1.0    0.0
vf_24     VFvf_24       zone_24 zone_36  0.0  0.0    0.0  1.0    0.0

vf_25     VFvf_25       zone_25 zone_37  0.0  0.0    0.0  1.0    0.0
vf_26     VFvf_26       zone_26 zone_38  0.0  0.0    0.0  1.0    0.0
vf_27     VFvf_27       zone_27 zone_39  0.0  0.0    0.0  1.0    0.0
vf_28     VFvf_28       zone_28 zone_40  0.0  0.0    0.0  1.0    0.0
vf_29     VFvf_29       zone_29 zone_41  0.0  0.0    0.0  1.0    0.0
vf_30     VFvf_30       zone_30 zone_42  0.0  0.0    0.0  1.0    0.0
vf_31     VFvf_31       zone_31 zone_43  0.0  0.0    0.0  1.0    0.0
vf_32     VFvf_32       zone_32 zone_44  0.0  0.0    0.0  1.0    0.0
vf_33     VFvf_33       zone_33 zone_45  0.0  0.0    0.0  1.0    0.0
vf_34     VFvf_34       zone_34 zone_46  0.0  0.0    0.0  1.0    0.0
vf_35     VFvf_35       zone_35 zone_47  0.0  0.0    0.0  1.0    0.0
vf_36     VFvf_36       zone_36 zone_48  0.0  0.0    0.0  1.0    0.0

vf_37     VFvf_37       zone_37 zone_49  0.0  0.0    0.0  1.0    0.0
vf_38     VFvf_38       zone_38 zone_50  0.0  0.0    0.0  1.0    0.0
vf_39     VFvf_39       zone_39 zone_51  0.0  0.0    0.0  1.0    0.0
vf_40     VFvf_40       zone_40 zone_52  0.0  0.0    0.0  1.0    0.0
vf_41     VFvf_41       zone_41 zone_53  0.0  0.0    0.0  1.0    0.0
vf_42     VFvf_42       zone_42 zone_54  0.0  0.0    0.0  1.0    0.0
vf_43     VFvf_43       zone_43 zone_55  0.0  0.0    0.0  1.0    0.0
```

```
vf_44    VFvf_44      zone_44 zone_56  0.0  0.0    0.0  1.0    0.0
vf_45    VFvf_45      zone_45 zone_57  0.0  0.0    0.0  1.0    0.0
vf_46    VFvf_46      zone_46 zone_58  0.0  0.0    0.0  1.0    0.0
vf_47    VFvf_47      zone_47 zone_59  0.0  0.0    0.0  1.0    0.0
vf_48    VFvf_48      zone_48 zone_60  0.0  0.0    0.0  1.0    0.0

je_1     JEje_1       zone_53  0Pa          0.0  0.0    0.0  1.0    0.0
je_2     JEje_2       zone_53  zone_54      0.0  0.0    0.0  1.0    0.0
je_3     JEje_3       zone_54  zone_55      0.0  0.0    0.0  1.0    0.0
je_4     JEje_4       zone_55  zone_56      0.0  0.0    0.0  1.0    0.0
```

```
&-SCH-WINdow schedules          25        --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |Schedule    |    Time                 | Opening Fraction    |
 |*Name       |                         |                     |
 | (-)        |    (-)                  |   (-)               |
 |____________|_________________________|_____________________|

&-SCH-FAN schedules             26        --- OPTIONAL DATASECTION ---

  _________________________________________________________
 |Schedule    |    Time               |      Fan Speed        |
 |*Name       |                       |                       |
 | (-)        |    (-)                |         (-)           |
 |____________|_______________________|_______________________|

&-SCH-TEMperature schedules       27        --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |Schedule    |    Time                      |    Temp        |
 |*Name       |                              |                |
 | (-)        |    (-)                       |    (oC)        |
 |____________|______________________________|________________|

&-SCH-HUMidity schedules        28        --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |Schedule    |    Time                |       Humidity       |
 |*Name       |                        |                      |
 | (-)        |    (-)                 |        (g/kg)        |
 |____________|________________________|______________________|

&-SCH-SINk schedules            29        --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |Schedule    |    Time                   | Sink Factor       |
 |*Name       |                           |                   |
 | (-)        |    (-)                    |     (-)           |
 |____________|___________________________|___________________|

&-SCH-SOUrce schedules          30        --- OPTIONAL DATASECTION ---
  _________________________________________________________
 |Schedule    |    Time        |      Source Factor or        |
 |*Name       |                |    Number of Occupants       |
 | (-)        |    (-)         |            (-)               |
 |____________|________________|______________________________|
```

```
&-SCH-OCCupant schedules          31        --- OPTIONAL DATASECTION ---
 ___________________________________________________________
|Schedule    |     Time            |  Zone     |  Activity Level |
|*Name       |                     |  ID       |  Factor         |
| (-)        |     (-)             |  (-)      |     (-)         |
|____________|___________________|__________|_________________|
```

```
&-CP-BUIlding reference height for Cp data 32 - OPTIONAL DATASECTION ---
 __________
| Height   |
| (m)      |
|__________|
```

```
&-CP-VALUes                         33        --- OPTIONAL DATASECTION ---
 _________________
|1.|Dataset Name  |
|__|______________|
```

```
 ________________________________________________________________________
|2.|Facade|    Winddirection           ( first line )                    |
|__|Elemno|    Cp Values               ( second and following lines )    |
|* (-)    |(deg) |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |[deg] |
|_________|______|______|______|______|______|______|______|______|______|
```

```
&-ENV-BUIlding related parameters  34       --- OPTIONAL DATASECTION ---
 _________________________________________________________________
|1.|Altitude| Angle Building  | Geographic Position              |
|__|        | North to X-Axis | Latitude + =N    |  Longitude + =R |
|    [m]    | [deg]           | [deg]     - =S   |  [deg]     - =W |
|___________|_________________|__________________|_________________|
   0          0                    43.0            0
```

```
&-ENV-WINd and meteo related parameters 35  --- OPTIONAL DATASECTION ---
 _____________________________________________________
|1.|Ref. Height      |  Altitude      | Wind Velocity    |
|__|for Wind Speed   | Meteo Station  | Profile Exponent |
|     [m]            |  [m]           | [m]              |
|__________________|_______________|__________________|
```

```
 ______________________________________________________________
|2.| Wind         |             |    Wind          |                |
|__| Direction|Plan Area    |Velocity Profile|  Surrounding    |
|     Angle     |Density      |    Exponent     |Buildings Height|
|    (deg)      |    (-)      |      (-)        |     (m)         |
|_____________|____________|_________________|________________|
```

```
&-SCH-METeo data                36       --- OPTIONAL DATASECTION ---

#---------------------
#  METEO DESCRIPTION
#---------------------

  ________________
 |1.|Dataset Name  |
 |__|______________|


  __________________________________________________________________
 |2.|Time              |        Wind        |Temperature|Humidity|Barometer|
 |__|                  |____________________|           |        |Pressure |
 |                     | Speed   |Direction|           |        |Absolute |
 |(-)                  |(m/sec)  |(deg)    |(oC)       |[g/kg]  |[kPa]    |
 |_____________________|_________|_________|___________|________|_________|


&-POL-DEScription               37       --- OPTIONAL DATASECTION ---
  ___________________________________________________________
 | No  |Name |Molar  |Mol/Cont |Vapor   |Diffu-|Adsorp.|Desorp.|
 | (-) |(-)  |Mass   | Fraction|Pressure|sitity|   Ka  | Kd    |
 |__   |     |[g/mol]| [mg/g]  |[mm Hg] |[m2/h]| [m/h] |[1/h]  |
 |1_|__|_____|_______|_________|________|______|_______|_______|

  1  SF6   146.0

  ___________________________________
 | density  |initial volume/ |initial |
 | (kg/l)   |thickness       | area   |
 |__        |    [ml/um]     | [m2]   |
 |_2|_______|________________|________|




&-GAS-RELease                  67     --- OPTIONAL DATASECTION ----
 __________________________________________________________________
|release|Ttotal|initial |initial|initial|Cp    |Cv    |puncture|discharge  |
| type  |mass  |pressure|temp.  |volume |[J/gK]|[J/gK]|area    |coefficient|
| [-]   | [kg] |[Pa]    |[K]    |[m3]   |      |      |[m2]    | [-]       |
|_______|______|________|_______|_______|______|______|________|___________|

 __________________________________________
|pipe  |pipe      |pipe friction|liquid heat |
|length|dimemeter |factor       |vaporization|
|[m]   |[m]       |[-]          |            |
|______|__________|_____________|____________|

&-LIQ-RELease                  68      --- OPTIONAL DATASECTION ----
 _____________________________________________________________________
|Tank|Tank    |tank  |puncture|discharge  |liquid |initial|initial tank|
|type|diameter|length|area    |coefficient|density|mass   |pressure    |
|[-] |[m]     |[m]   |[m2]    |[-]        |[kg/m3]|[kg]   |[Pa]        |
|____|________|______|________|___________|_______|_______|____________|
```

```
&-SUPPLY                         69      ---- OPTIONAL DATASECTION ----
 _______________________________________
|Supply     |supply       |Supply         |
|zone no    |Temperature  |Concentration  |
| Nsu (-)   | Tsu (0C)    |Csu (kg/kg)    |
|___________|_____________|_______________|
 53          33.5           0.0

&-SCH-POL outdoor concentration data  38    --- OPTIONAL DATASECTION ---

  _________________
 |1.|DATASET NAME   |
 |__|_______________|


  ___________________________________________________________________________
 |2.| Time          |      Pollutant  Concentration                          |
 |__|               |________________________________________________________|
 |                  |  No1       |  No2       |  No3       |  No4       |  No5       |
 |      (-)         | (kg/kg)    | [kg/kg]    | [kg/kg]    | [kg/kg]    | [kg/kg]    |
 |__________________|____________|____________|____________|____________|____________|


&-OCCUPANt description            39        --- OPTIONAL DATASECTION ---
  _____________________________________________________
 |No  |Sex    |Age   |Height  |Mass  |Activity|Cigarets    |
 |(-) |(-)    |(a)   | (m)    |(kg)  | (W/m2) | [1/h]      |
 |____|_______|______|________|______|________|____________|



&-NORM-CR Standard temperature for crack data  44 - OPTIONAL DATASECTION --
-
  ____________________
 |Standard Temperature|
 | for the Crack Data |
 |   (default 20 C)   |
 |     [deg C]        |
 |____________________|

20 102.3 1
#EOC
```

Appendix B - Results output

```
COwZ Version: 1.0A

 ******************************
 Reading Input File           *
 ******************************

 ***CER*** WARNING ***
 At &-PR-SIMUlation 5 output pollutants are requested.
 At &-POL-DES there is only 1 . Output is reduced to 1 pollutant.
 ----------------------------------------------------------------

 ******************************
 Checking HVAC T-Junction data *
 ******************************


 ******************************
 Looking for RF components    *
 ******************************


 ******************************
 Looking for Pollutant names   *
 ******************************


 ******************************
 Check Schedule and Pollutants *
 ******************************


 ****************************************
 Check: Are all used schedules defined ?*
 ****************************************


 THE OUTPUT STARTS HERE!!
 ******************************************************************************

 Input file:
 cowz.cif

 Model name:
 1.0
 At time =  2002jun11_00:00:00   Tuesday  , interval =        86400 seconds


 The maximum allowed (see *CIF &-PR-CONTrol) is:       10000
 ***CER*** WARNING ***
 Pollutant transport calculation: Tau_zone
 < 100 sec, Delta-t set to 1 sec
 ----------------------------------------------------------------
  NO poltrans    ERRORS REPORTED

           0 iterations with Solver=          5

 =========================================================================

 Ventilation output
 ==================

  Zone-ID     pressure    Temperature   totalflow     imbalance
                Pa              C     kg/h              kg/h
 ------------------------------------------------------------
  zone_1        23.688      19.586      38.            -4.251E-10
  zone_2        23.688      19.579      34.66           9.804E-10
  zone_3        23.688      19.567      36.79           2.663E-09
  zone_4        23.687      19.603      31.08           9.736E-10
  zone_5        23.688      19.540      29.06           4.928E-10
  zone_6        23.688      19.528      31.01          -3.646E-10
  zone_7        23.688      19.542      38.06          -3.344E-09
  zone_8        23.688      19.554      20.42           3.876E-10
```

zone_9	23.688	19.585	37.57	-9.522E-11
zone_10	23.688	19.573	33.95	1.389E-09
zone_11	23.688	19.554	35.86	-6.412E-10
zone_12	23.687	19.592	26.33	1.497E-09
zone_13	17.776	19.689	38.	2.742E-10
zone_14	17.776	19.768	31.98	-1.438E-09
zone_15	17.776	19.804	41.59	-3.293E-09
zone_16	17.776	19.785	42.54	-1.088E-09
zone_17	17.776	19.773	32.39	-1.779E-09
zone_18	17.776	19.813	20.58	5.91E-10
zone_19	17.776	19.813	40.33	4.073E-09
zone_20	17.776	19.809	73.79	1.816E-08
zone_21	17.776	19.694	37.57	4.804E-10
zone_22	17.776	19.776	32.55	-9.965E-10
zone_23	17.776	19.820	48.68	-1.376E-09
zone_24	17.776	19.795	40.52	-3.888E-10
zone_25	11.870	20.192	8.809	5.084E-10
zone_26	11.870	20.093	5.339	8.013E-11
zone_27	11.869	20.045	18.56	9.737E-10
zone_28	11.870	20.065	29.84	-7.756E-09
zone_29	11.869	20.093	13.76	6.949E-10
zone_30	11.869	20.052	9.951	4.005E-11
zone_31	11.870	20.050	34.47	-3.941E-08
zone_32	11.870	20.089	90.56	3.691E-08
zone_33	11.870	20.188	8.926	1.554E-10
zone_34	11.869	20.086	5.927	-3.992E-10
zone_35	11.869	20.024	24.61	1.849E-10
zone_36	11.870	20.052	31.17	-8.817E-09
zone_37	5.977	21.033	44.55	-2.485E-10
zone_38	5.978	21.164	62.2	3.7E-10
zone_39	5.978	21.279	87.49	5.74E-09
zone_40	5.979	21.341	107.1	4.706E-09
zone_41	5.976	21.020	150.3	2.87E-10
zone_42	5.977	21.163	132.3	2.498E-09
zone_43	5.978	21.259	120.9	-2.243E-08
zone_44	5.979	21.272	83.84	-8.402E-09
zone_45	5.977	21.041	44.46	-1.773E-10
zone_46	5.978	21.176	61.48	1.109E-10
zone_47	5.978	21.301	81.52	-1.492E-09
zone_48	5.979	21.353	106.	8.786E-09
zone_49	0.107	22.326	40.02	-5.086E-10
zone_50	0.106	22.150	59.92	-1.883E-09
zone_51	0.106	21.898	85.62	-7.172E-08
zone_52	0.105	21.634	96.71	-7.107E-08
zone_53	0.108	23.007	173.1	-0.01005
zone_54	0.107	22.313	146.3	0.003777
zone_55	0.106	21.955	137.2	0.006871
zone_56	0.105	21.777	88.32	-0.006033
zone_57	0.107	22.321	40.	-3.196E-10
zone_58	0.106	22.143	59.62	-1.321E-09
zone_59	0.106	21.885	82.84	6.019E-09
zone_60	0.105	21.623	97.85	-7.682E-08

link nr	name	type	from typ	from name	to typ	to name	Tlink C	Dp-link Pa	fma1 kg/h	fma2 kg/h
1	hf_1	HFhf_1	zn	zone_1	zn	zone_2	20.	1.99E-04	3.272E+01	0.E+00
2	hf_2	HFhf_2	zn	zone_2	zn	zone_3	20.	1.36E-04	2.702E+01	0.E+00
3	hf_3	HFhf_3	zn	zone_3	zn	zone_4	20.	8.36E-05	1.941E+01	0.E+00
4	hf_4	HFhf_4	zn	zone_5	zn	zone_6	20.	1.3E-04	2.906E+01	0.E+00
5	hf_5	HFhf_5	zn	zone_6	zn	zone_7	20.	1.16E-04	2.749E+01	0.E+00
6	hf_6	HFhf_6	zn	zone_7	zn	zone_8	20.	7.62E-05	1.944E+01	0.E+00
7	hf_7	HFhf_7	zn	zone_9	zn	zone_10	20.	1.95E-04	3.237E+01	0.E+00
8	hf_8	HFhf_8	zn	zone_10	zn	zone_11	20.	1.35E-04	2.701E+01	0.E+00
9	hf_9	HFhf_9	zn	zone_11	zn	zone_12	20.	7.58E-05	1.758E+01	0.E+00
10	hf_10	HFhf_10	zn	zone_13	zn	zone_14	20.	-1.62E-04	0.E+00	2.949E+01
11	hf_11	HFhf_11	zn	zone_14	zn	zone_15	20.	-1.1E-04	0.E+00	2.434E+01
12	hf_12	HFhf_12	zn	zone_15	zn	zone_16	20.	-4.74E-05	0.E+00	1.099E+01
13	hf_13	HFhf_13	zn	zone_17	zn	zone_18	20.	-7.3E-05	0.E+00	1.863E+01
14	hf_14	HFhf_14	zn	zone_18	zn	zone_19	20.	-5.94E-05	0.E+00	1.516E+01
15	hf_15	HFhf_15	zn	zone_19	zn	zone_20	20.	3.8E-05	9.686E+00	0.E+00
16	hf_16	HFhf_16	zn	zone_21	zn	zone_22	20.	-1.62E-04	0.E+00	2.949E+01
17	hf_17	HFhf_17	zn	zone_22	zn	zone_23	20.	-1.22E-04	0.E+00	2.561E+01
18	hf_18	HFhf_18	zn	zone_23	zn	zone_24	20.	-3.44E-05	0.E+00	7.967E+00
19	hf_19	HFhf_19	zn	zone_25	zn	zone_26	20.	1.99E-05	4.617E+00	0.E+00
20	hf_20	HFhf_20	zn	zone_26	zn	zone_27	20.	5.01E-06	1.161E+00	0.E+00

21	hf_21	HFhf_21	zn	zone_27	zn	zone_28	20.	-3.44E-05	0.E+00	7.976E+00
22	hf_22	HFhf_22	zn	zone_29	zn	zone_30	20.	-5.33E-06	0.E+00	1.359E+00
23	hf_23	HFhf_23	zn	zone_30	zn	zone_31	20.	-3.7E-05	0.E+00	9.427E+00
24	hf_24	HFhf_24	zn	zone_31	zn	zone_32	20.	-1.34E-04	0.E+00	2.956E+01
25	hf_25	HFhf_25	zn	zone_33	zn	zone_34	20.	2.19E-05	5.067E+00	0.E+00
26	hf_26	HFhf_26	zn	zone_34	zn	zone_35	20.	9.39E-06	2.176E+00	0.E+00
27	hf_27	HFhf_27	zn	zone_35	zn	zone_36	20.	-3.82E-05	0.E+00	8.857E+00
28	hf_28	HFhf_28	zn	zone_37	zn	zone_38	20.	-2.63E-04	0.E+00	3.753E+01
29	hf_29	HFhf_29	zn	zone_38	zn	zone_39	20.	-6.41E-04	0.E+00	5.855E+01
30	hf_30	HFhf_30	zn	zone_39	zn	zone_40	20.	-8.09E-04	0.E+00	6.579E+01
31	hf_31	HFhf_31	zn	zone_41	zn	zone_42	20.	-9.63E-04	0.E+00	7.899E+01
32	hf_32	HFhf_32	zn	zone_42	zn	zone_43	20.	-9.89E-04	0.E+00	8.003E+01
33	hf_33	HFhf_33	zn	zone_43	zn	zone_44	20.	-6.75E-04	0.E+00	6.61E+01
34	hf_34	HFhf_34	zn	zone_45	zn	zone_46	20.	-2.59E-04	0.E+00	3.722E+01
35	hf_35	HFhf_35	zn	zone_46	zn	zone_47	20.	-6.23E-04	0.E+00	5.773E+01
36	hf_36	HFhf_36	zn	zone_47	zn	zone_48	20.	-8.23E-04	0.E+00	6.637E+01
37	hf_37	HFhf_37	zn	zone_49	zn	zone_50	20.	2.04E-04	3.3E+01	0.E+00
38	hf_38	HFhf_38	zn	zone_50	zn	zone_51	20.	6.73E-04	5.992E+01	0.E+00
39	hf_39	HFhf_39	zn	zone_51	zn	zone_52	20.	8.98E-04	6.927E+01	0.E+00
40	hf_40	HFhf_40	zn	zone_53	zn	zone_54	20.	1.11E-03	8.181E+01	0.E+00
41	hf_41	HFhf_41	zn	zone_54	zn	zone_55	20.	1.15E-03	8.048E+01	0.E+00
42	hf_42	HFhf_42	zn	zone_55	zn	zone_56	20.	8.84E-04	6.455E+01	0.E+00
43	hf_43	HFhf_43	zn	zone_57	zn	zone_58	20.	2.01E-04	3.276E+01	0.E+00
44	hf_44	HFhf_44	zn	zone_58	zn	zone_59	20.	6.66E-04	5.962E+01	0.E+00
45	hf_45	HFhf_45	zn	zone_59	zn	zone_60	20.	9.14E-04	6.987E+01	0.E+00
46	hf_46	HFhf_46	zn	zone_1	zn	zone_5	20.	5.06E-05	5.279E+00	0.E+00
47	hf_47	HFhf_47	zn	zone_2	zn	zone_6	20.	-1.86E-05	0.E+00	1.942E+00
48	hf_48	HFhf_48	zn	zone_3	zn	zone_7	20.	-3.83E-05	0.E+00	9.768E+00
49	hf_49	HFhf_49	zn	zone_4	zn	zone_8	20.	-4.57E-05	0.E+00	1.167E+01
50	hf_50	HFhf_50	zn	zone_5	zn	zone_9	20.	-4.98E-05	0.E+00	5.2E+00
51	hf_51	HFhf_51	zn	zone_6	zn	zone_10	20.	1.52E-05	1.583E+00	0.E+00
52	hf_52	HFhf_52	zn	zone_7	zn	zone_11	20.	3.47E-05	8.85E+00	0.E+00
53	hf_53	HFhf_53	zn	zone_8	zn	zone_12	20.	3.43E-05	8.745E+00	0.E+00
54	hf_54	HFhf_54	zn	zone_13	zn	zone_17	20.	-7.16E-05	0.E+00	7.475E+00
55	hf_55	HFhf_55	zn	zone_14	zn	zone_18	20.	1.69E-05	1.768E+00	0.E+00
56	hf_56	HFhf_56	zn	zone_15	zn	zone_19	20.	6.76E-05	1.725E+01	0.E+00
57	hf_57	HFhf_57	zn	zone_16	zn	zone_20	20.	1.53E-04	3.156E+01	0.E+00
58	hf_58	HFhf_58	zn	zone_17	zn	zone_21	20.	6.07E-05	6.333E+00	0.E+00
59	hf_59	HFhf_59	zn	zone_18	zn	zone_22	20.	-2.8E-05	0.E+00	2.92E+00
60	hf_60	HFhf_60	zn	zone_19	zn	zone_23	20.	-9.05E-05	0.E+00	2.308E+01
61	hf_61	HFhf_61	zn	zone_20	zn	zone_24	20.	-1.63E-04	0.E+00	3.255E+01
62	hf_62	HFhf_62	zn	zone_25	zn	zone_29	20.	3.03E-05	3.157E+00	0.E+00
63	hf_63	HFhf_63	zn	zone_26	zn	zone_30	20.	5.02E-06	5.239E-01	0.E+00
64	hf_64	HFhf_64	zn	zone_27	zn	zone_31	20.	-3.69E-05	0.E+00	9.423E+00
65	hf_65	HFhf_65	zn	zone_28	zn	zone_32	20.	-1.37E-04	0.E+00	2.984E+01
66	hf_66	HFhf_66	zn	zone_29	zn	zone_33	20.	-2.03E-05	0.E+00	2.116E+00
67	hf_67	HFhf_67	zn	zone_30	zn	zone_34	20.	6.9E-06	7.198E-01	0.E+00
68	hf_68	HFhf_68	zn	zone_31	zn	zone_35	20.	5.33E-05	1.358E+01	0.E+00
69	hf_69	HFhf_69	zn	zone_32	zn	zone_36	20.	1.49E-04	3.117E+01	0.E+00
70	hf_70	HFhf_70	zn	zone_37	zn	zone_41	20.	1.18E-03	3.574E+01	0.E+00
71	hf_71	HFhf_71	zn	zone_38	zn	zone_42	20.	4.78E-04	2.276E+01	0.E+00
72	hf_72	HFhf_72	zn	zone_39	zn	zone_43	20.	1.29E-04	2.894E+01	0.E+00
73	hf_73	HFhf_73	zn	zone_40	zn	zone_44	20.	2.64E-04	4.131E+01	0.E+00
74	hf_74	HFhf_74	zn	zone_41	zn	zone_45	20.	-1.16E-03	0.E+00	3.553E+01
75	hf_75	HFhf_75	zn	zone_42	zn	zone_46	20.	-4.6E-04	0.E+00	2.232E+01
76	hf_76	HFhf_76	zn	zone_43	zn	zone_47	20.	-9.35E-05	0.E+00	2.378E+01
77	hf_77	HFhf_77	zn	zone_44	zn	zone_48	20.	-2.42E-04	0.E+00	3.96E+01
78	hf_78	HFhf_78	zn	zone_49	zn	zone_53	20.	-1.49E-03	0.E+00	4.002E+01
79	hf_79	HFhf_79	zn	zone_50	zn	zone_54	20.	-5.79E-04	0.E+00	2.501E+01
80	hf_80	HFhf_80	zn	zone_51	zn	zone_55	20.	-1.02E-04	0.E+00	2.57E+01
81	hf_81	HFhf_81	zn	zone_52	zn	zone_56	20.	-1.16E-04	0.E+00	2.744E+01
82	hf_82	HFhf_82	zn	zone_53	zn	zone_57	20.	1.49E-03	4.E+01	0.E+00
83	hf_83	HFhf_83	zn	zone_54	zn	zone_58	20.	5.75E-04	2.492E+01	0.E+00
84	hf_84	HFhf_84	zn	zone_55	zn	zone_59	20.	9.13E-05	2.322E+01	0.E+00
85	hf_85	HFhf_85	zn	zone_56	zn	zone_60	20.	1.21E-04	2.799E+01	0.E+00
86	hf_86	HFhf_86	zn	zone_56	sp	0Pa	20.	1.05E-01	2.996E+01	0.E+00
87	vf_1	VFvf_1	zn	zone_1	zn	zone_13	20.	5.91E+00	0.E+00	3.8E+01
88	vf_2	VFvf_2	zn	zone_2	zn	zone_14	20.	5.91E+00	7.638E+00	0.E+00
89	vf_3	VFvf_3	zn	zone_3	zn	zone_15	20.	5.91E+00	1.738E+01	0.E+00
90	vf_4	VFvf_4	zn	zone_4	zn	zone_16	20.	5.91E+00	3.108E+01	0.E+00
91	vf_5	VFvf_5	zn	zone_5	zn	zone_17	20.	5.91E+00	0.E+00	1.858E+01
92	vf_6	VFvf_6	zn	zone_6	zn	zone_18	20.	5.91E+00	0.E+00	1.947E+00
93	vf_7	VFvf_7	zn	zone_7	zn	zone_19	20.	5.91E+00	0.E+00	1.058E+01
94	vf_8	VFvf_8	zn	zone_8	zn	zone_20	20.	5.91E+00	0.E+00	9.74E-01
95	vf_9	VFvf_9	zn	zone_9	zn	zone_21	20.	5.91E+00	0.E+00	3.757E+01
96	vf_10	VFvf_10	zn	zone_10	zn	zone_22	20.	5.91E+00	6.947E+00	0.E+00
97	vf_11	VFvf_11	zn	zone_11	zn	zone_23	20.	5.91E+00	1.828E+01	0.E+00

```
 98 vf_12  VFvf_12    zn zone_12  zn zone_24     20.  5.91E+00   2.633E+01     0.E+00
 99 vf_13  VFvf_13    zn zone_13  zn zone_25     20.  5.91E+00      0.E+00  1.034E+00
100 vf_14  VFvf_14    zn zone_14  zn zone_26     20.  5.91E+00    7.22E-01     0.E+00
101 vf_15  VFvf_15    zn zone_15  zn zone_27     20.  5.91E+00      0.E+00  1.322E+01
102 vf_16  VFvf_16    zn zone_16  zn zone_28     20.  5.91E+00      0.E+00  1.147E+01
103 vf_17  VFvf_17    zn zone_17  zn zone_29     20.  5.91E+00      0.E+00  1.376E+01
104 vf_18  VFvf_18    zn zone_18  zn zone_30     20.  5.91E+00      0.E+00  7.361E-01
105 vf_19  VFvf_19    zn zone_19  zn zone_31     20.  5.91E+00   4.911E+00     0.E+00
106 vf_20  VFvf_20    zn zone_20  zn zone_32     20.  5.91E+00   7.282E+01     0.E+00
107 vf_21  VFvf_21    zn zone_21  zn zone_33     20.  5.91E+00      0.E+00  1.743E+00
108 vf_22  VFvf_22    zn zone_22  zn zone_34     20.  5.91E+00   1.401E-01     0.E+00
109 vf_23  VFvf_23    zn zone_23  zn zone_35     20.  5.91E+00      0.E+00  2.244E+01
110 vf_24  VFvf_24    zn zone_24  zn zone_36     20.  5.91E+00      0.E+00  1.419E+01
111 vf_25  VFvf_25    zn zone_25  zn zone_37     20.  5.89E+00      0.E+00  8.809E+00
112 vf_26  VFvf_26    zn zone_26  zn zone_38     20.  5.89E+00   3.655E+00     0.E+00
113 vf_27  VFvf_27    zn zone_27  zn zone_39     20.  5.89E+00   5.341E+00     0.E+00
114 vf_28  VFvf_28    zn zone_28  zn zone_40     20.  5.89E+00   1.039E+01     0.E+00
115 vf_29  VFvf_29    zn zone_29  zn zone_41     20.  5.89E+00      0.E+00  7.126E+00
116 vf_30  VFvf_30    zn zone_30  zn zone_42     20.  5.89E+00   7.136E+00     0.E+00
117 vf_31  VFvf_31    zn zone_31  zn zone_43     20.  5.89E+00   2.038E+00     0.E+00
118 vf_32  VFvf_32    zn zone_32  zn zone_44     20.  5.89E+00      0.E+00  1.774E+01
119 vf_33  VFvf_33    zn zone_33  zn zone_45     20.  5.89E+00      0.E+00  8.926E+00
120 vf_34  VFvf_34    zn zone_34  zn zone_46     20.  5.89E+00   3.751E+00     0.E+00
121 vf_35  VFvf_35    zn zone_35  zn zone_47     20.  5.89E+00   2.172E+00     0.E+00
122 vf_36  VFvf_36    zn zone_36  zn zone_48     20.  5.89E+00   8.118E+00     0.E+00
123 vf_37  VFvf_37    zn zone_37  zn zone_49     20.  5.87E+00      0.E+00  7.018E+00
124 vf_38  VFvf_38    zn zone_38  zn zone_50     20.  5.87E+00   1.911E+00     0.E+00
125 vf_39  VFvf_39    zn zone_39  zn zone_51     20.  5.87E+00      0.E+00  1.636E+01
126 vf_40  VFvf_40    zn zone_40  zn zone_52     20.  5.87E+00      0.E+00  9.671E+01
127 vf_41  VFvf_41    zn zone_41  zn zone_53     20.  5.87E+00   1.431E+02     0.E+00
128 vf_42  VFvf_42    zn zone_42  zn zone_54     20.  5.87E+00   5.326E+01     0.E+00
129 vf_43  VFvf_43    zn zone_43  zn zone_55     20.  5.87E+00   4.083E+01     0.E+00
130 vf_44  VFvf_44    zn zone_44  zn zone_56     20.  5.87E+00      0.E+00  2.938E+00
131 vf_45  VFvf_45    zn zone_45  zn zone_57     20.  5.87E+00      0.E+00  7.242E+00
132 vf_46  VFvf_46    zn zone_46  zn zone_58     20.  5.87E+00    1.94E+00     0.E+00
133 vf_47  VFvf_47    zn zone_47  zn zone_59     20.  5.87E+00      0.E+00  1.297E+01
134 vf_48  VFvf_48    zn zone_48  zn zone_60     20.  5.87E+00      0.E+00  9.785E+01
135 je_1   JEje_1     zn zone_53  sp 0Pa         20.  1.08E-01      0.E+00  2.995E+01
136 je_2   JEje_2     zn zone_53  zn zone_54     20.  1.11E-03   1.127E+01     0.E+00
137 je_3   JEje_3     zn zone_54  zn zone_55     20.  1.15E-03   1.594E+01     0.E+00
138 je_4   JEje_4     zn zone_55  zn zone_56     20.  8.84E-04   2.376E+01     0.E+00
================================================================================

Pollutant transport output
==========================
Outside concentration mg/kg
 ExtNr    SF6
convers. 1.E+06

 2002jun11_00:00:00   Tuesday Pollutant Nr.          1(SF6)
   Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s              kg/s        mg/kg
    1.00         1.00               1.00        0.100E+07
----------------------------------------------------------
  zone_1   0.         0.           0   0.            0.
  zone_2   0.         0.           0   0.            0.
  zone_3   0.         0.           0   0.            0.
  zone_4   0.         0.           0   0.            0.
  zone_5   0.         0.           0   0.            0.
  zone_6   0.         0.           0   0.            0.
  zone_7   0.         0.           0   0.            0.
  zone_8   0.         0.           0   0.            0.
  zone_9   0.         0.           0   0.            0.
  zone_10  0.         0.           0   0.            0.
  zone_11  0.         0.           0   0.            0.
  zone_12  0.         0.           0   0.            0.
  zone_13  0.         0.           0   0.            0.
  zone_14  0.         0.           0   0.            0.
  zone_15  0.         0.           0   0.            0.
  zone_16  0.         0.           0   0.            0.
  zone_17  0.         0.           0   0.            0.
  zone_18  0.         0.           0   0.            0.
  zone_19  0.         0.           0   0.            0.
  zone_20  0.         0.           0   0.            0.
  zone_21  0.         0.           0   0.            0.
  zone_22  0.         0.           0   0.            0.
  zone_23  0.         0.           0   0.            0.
```

```
  zone_24  0.         0.           0   0.            0.
  zone_25  0.         0.           0   0.            0.
  zone_26  0.         0.           0   0.            0.
  zone_27  0.         0.           0   0.            0.
  zone_28  0.         0.           0   0.            0.
  zone_29  0.         0.           0   0.            0.
  zone_30  0.         0.           0   0.            0.
  zone_31  2.943E-06  0.           0   0.            0.
  zone_32  0.         0.           0   0.            0.
  zone_33  0.         0.           0   0.            0.
  zone_34  0.         0.           0   0.            0.
  zone_35  0.         0.           0   0.            0.
  zone_36  0.         0.           0   0.            0.
  zone_37  0.         0.           0   0.            0.
  zone_38  0.         0.           0   0.            0.
  zone_39  0.         0.           0   0.            0.
  zone_40  0.         0.           0   0.            0.
  zone_41  0.         0.           0   0.            0.
  zone_42  0.         0.           0   0.            0.
  zone_43  0.         0.           0   0.            0.
  zone_44  0.         0.           0   0.            0.
  zone_45  0.         0.           0   0.            0.
  zone_46  0.         0.           0   0.            0.
  zone_47  0.         0.           0   0.            0.
  zone_48  0.         0.           0   0.            0.
  zone_49  0.         0.           0   0.            0.
  zone_50  0.         0.           0   0.            0.
  zone_51  0.         0.           0   0.            0.
  zone_52  0.         0.           0   0.            0.
  zone_53  0.         0.           0   0.            0.
  zone_54  0.         0.           0   0.            0.
  zone_55  0.         0.           0   0.            0.
  zone_56  0.         0.           0   0.            0.
  zone_57  0.         0.           0   0.            0.
  zone_58  0.         0.           0   0.            0.
  zone_59  0.         0.           0   0.            0.
  zone_60  0.         0.           0   0.            0.
Cave=
     0.00000000
********************************************************************************

Input file:
cowz.cif

Model name:
1.0
At time =  2002jun12_00:00:00 Wednesday  , interval =            0 seconds


The maximum allowed (see *CIF &-PR-CONTrol) is:       10000
 NO poltrans    ERRORS REPORTED

          0 iterations with Solver=          5

================================================================================

Ventilation output
==================

 Zone-ID     pressure    Temperature   totalflow     imbalance
               Pa              C     kg/h               kg/h
------------------------------------------------------------
 zone_1        23.688      19.586      37.98           3.961E-10
 zone_2        23.688      19.579      34.64           3.364E-10
 zone_3        23.688      19.567      36.76          -1.507E-10
 zone_4        23.687      19.603      31.09          -2.117E-09
 zone_5        23.688      19.540      29.09          -2.504E-10
 zone_6        23.688      19.528      31.            -4.682E-10
 zone_7        23.688      19.542      38.07          -1.595E-09
 zone_8        23.688      19.554      20.44          -1.782E-09
 zone_9        23.688      19.584      37.53          -2.081E-11
 zone_10       23.688      19.572      33.97           9.374E-10
 zone_11       23.688      19.554      35.86           5.934E-10
 zone_12       23.687      19.592      26.35           1.041E-09
 zone_13       17.776      19.688      37.98           2.889E-11
 zone_14       17.776      19.769      31.98          -2.097E-10
 zone_15       17.776      19.805      41.63           2.263E-09
```

zone_16	17.776	19.784	42.51	2.613E-09
zone_17	17.776	19.772	32.46	-1.807E-10
zone_18	17.776	19.811	20.6	-2.17E-09
zone_19	17.776	19.814	40.32	4.199E-09
zone_20	17.776	19.808	73.78	1.048E-08
zone_21	17.776	19.693	37.53	4.896E-10
zone_22	17.776	19.776	32.59	4.738E-10
zone_23	17.776	19.820	48.64	-3.134E-09
zone_24	17.776	19.795	40.49	1.433E-09
zone_25	11.870	20.190	8.757	-4.064E-10
zone_26	11.869	20.095	5.267	4.746E-10
zone_27	11.869	20.045	18.55	-1.5E-09
zone_28	11.870	20.065	29.82	-5.016E-09
zone_29	11.869	20.092	13.77	6.505E-11
zone_30	11.869	20.053	9.871	8.736E-10
zone_31	11.870	20.051	34.32	-2.252E-08
zone_32	11.870	20.089	90.53	1.925E-08
zone_33	11.870	20.184	8.872	-5.598E-10
zone_34	11.869	20.085	5.912	2.122E-10
zone_35	11.869	20.024	24.63	1.191E-09
zone_36	11.870	20.052	31.17	-4.721E-09
zone_37	5.977	21.035	44.5	4.73E-11
zone_38	5.978	21.168	62.17	6.855E-12
zone_39	5.978	21.282	87.48	2.171E-09
zone_40	5.979	21.341	107.1	2.082E-09
zone_41	5.976	21.021	150.3	1.693E-10
zone_42	5.977	21.164	132.3	4.08E-09
zone_43	5.978	21.259	120.7	-9.555E-09
zone_44	5.979	21.272	83.83	-4.686E-09
zone_45	5.977	21.041	44.4	1.001E-10
zone_46	5.978	21.176	61.44	-1.032E-10
zone_47	5.978	21.299	81.5	-1.605E-09
zone_48	5.979	21.352	106.	4.172E-09
zone_49	0.107	22.327	40.02	-1.521E-10
zone_50	0.106	22.151	59.95	-1.993E-09
zone_51	0.106	21.899	85.69	-2.588E-08
zone_52	0.105	21.635	96.7	-3.748E-08
zone_53	0.108	23.008	173.1	-0.006362
zone_54	0.107	22.313	146.4	0.001767
zone_55	0.106	21.956	137.1	0.003833
zone_56	0.105	21.778	88.28	-0.004453
zone_57	0.107	22.321	40.	-1.506E-10
zone_58	0.106	22.143	59.63	-1.774E-09
zone_59	0.106	21.886	82.74	3.367E-09
zone_60	0.105	21.624	97.81	-3.989E-08

link nr	name	type	from typ	from name	to typ	to name	Tlink C	Dp-link Pa	fma1 kg/h	fma2 kg/h
1	hf_1	HFhf_1	zn	zone_1	zn	zone_2	20.	1.99E-04	3.271E+01	0.E+00
2	hf_2	HFhf_2	zn	zone_2	zn	zone_3	20.	1.36E-04	2.701E+01	0.E+00
3	hf_3	HFhf_3	zn	zone_3	zn	zone_4	20.	8.37E-05	1.942E+01	0.E+00
4	hf_4	HFhf_4	zn	zone_5	zn	zone_6	20.	1.3E-04	2.909E+01	0.E+00
5	hf_5	HFhf_5	zn	zone_6	zn	zone_7	20.	1.16E-04	2.747E+01	0.E+00
6	hf_6	HFhf_6	zn	zone_7	zn	zone_8	20.	7.62E-05	1.945E+01	0.E+00
7	hf_7	HFhf_7	zn	zone_9	zn	zone_10	20.	1.95E-04	3.237E+01	0.E+00
8	hf_8	HFhf_8	zn	zone_10	zn	zone_11	20.	1.35E-04	2.698E+01	0.E+00
9	hf_9	HFhf_9	zn	zone_11	zn	zone_12	20.	7.58E-05	1.758E+01	0.E+00
10	hf_10	HFhf_10	zn	zone_13	zn	zone_14	20.	-1.62E-04	0.E+00	2.952E+01
11	hf_11	HFhf_11	zn	zone_14	zn	zone_15	20.	-1.1E-04	0.E+00	2.435E+01
12	hf_12	HFhf_12	zn	zone_15	zn	zone_16	20.	-4.72E-05	0.E+00	1.095E+01
13	hf_13	HFhf_13	zn	zone_17	zn	zone_18	20.	-7.33E-05	0.E+00	1.869E+01
14	hf_14	HFhf_14	zn	zone_18	zn	zone_19	20.	-5.98E-05	0.E+00	1.525E+01
15	hf_15	HFhf_15	zn	zone_19	zn	zone_20	20.	3.8E-05	9.692E+00	0.E+00
16	hf_16	HFhf_16	zn	zone_21	zn	zone_22	20.	-1.62E-04	0.E+00	2.953E+01
17	hf_17	HFhf_17	zn	zone_22	zn	zone_23	20.	-1.22E-04	0.E+00	2.56E+01
18	hf_18	HFhf_18	zn	zone_23	zn	zone_24	20.	-3.43E-05	0.E+00	7.954E+00
19	hf_19	HFhf_19	zn	zone_25	zn	zone_26	20.	1.99E-05	4.616E+00	0.E+00
20	hf_20	HFhf_20	zn	zone_26	zn	zone_27	20.	5.02E-06	1.164E+00	0.E+00
21	hf_21	HFhf_21	zn	zone_27	zn	zone_28	20.	-3.44E-05	0.E+00	7.979E+00
22	hf_22	HFhf_22	zn	zone_29	zn	zone_30	20.	-5.4E-06	0.E+00	1.378E+00
23	hf_23	HFhf_23	zn	zone_30	zn	zone_31	20.	-3.67E-05	0.E+00	9.364E+00
24	hf_24	HFhf_24	zn	zone_31	zn	zone_32	20.	-1.34E-04	0.E+00	2.955E+01
25	hf_25	HFhf_25	zn	zone_33	zn	zone_34	20.	2.19E-05	5.076E+00	0.E+00
26	hf_26	HFhf_26	zn	zone_34	zn	zone_35	20.	9.6E-06	2.225E+00	0.E+00
27	hf_27	HFhf_27	zn	zone_35	zn	zone_36	20.	-3.81E-05	0.E+00	8.832E+00

28	hf_28	HFhf_28	zn	zone_37	zn	zone_38	20.	-2.63E-04	0.E+00	3.75E+01
29	hf_29	HFhf_29	zn	zone_38	zn	zone_39	20.	-6.41E-04	0.E+00	5.857E+01
30	hf_30	HFhf_30	zn	zone_39	zn	zone_40	20.	-8.09E-04	0.E+00	6.58E+01
31	hf_31	HFhf_31	zn	zone_41	zn	zone_42	20.	-9.63E-04	0.E+00	7.899E+01
32	hf_32	HFhf_32	zn	zone_42	zn	zone_43	20.	-9.89E-04	0.E+00	8.003E+01
33	hf_33	HFhf_33	zn	zone_43	zn	zone_44	20.	-6.74E-04	0.E+00	6.609E+01
34	hf_34	HFhf_34	zn	zone_45	zn	zone_46	20.	-2.58E-04	0.E+00	3.719E+01
35	hf_35	HFhf_35	zn	zone_46	zn	zone_47	20.	-6.23E-04	0.E+00	5.775E+01
36	hf_36	HFhf_36	zn	zone_47	zn	zone_48	20.	-8.24E-04	0.E+00	6.639E+01
37	hf_37	HFhf_37	zn	zone_49	zn	zone_50	20.	2.05E-04	3.303E+01	0.E+00
38	hf_38	HFhf_38	zn	zone_50	zn	zone_51	20.	6.74E-04	5.995E+01	0.E+00
39	hf_39	HFhf_39	zn	zone_51	zn	zone_52	20.	8.97E-04	6.923E+01	0.E+00
40	hf_40	HFhf_40	zn	zone_53	zn	zone_54	20.	1.11E-03	8.182E+01	0.E+00
41	hf_41	HFhf_41	zn	zone_54	zn	zone_55	20.	1.15E-03	8.05E+01	0.E+00
42	hf_42	HFhf_42	zn	zone_55	zn	zone_56	20.	8.83E-04	6.452E+01	0.E+00
43	hf_43	HFhf_43	zn	zone_57	zn	zone_58	20.	2.02E-04	3.278E+01	0.E+00
44	hf_44	HFhf_44	zn	zone_58	zn	zone_59	20.	6.66E-04	5.963E+01	0.E+00
45	hf_45	HFhf_45	zn	zone_59	zn	zone_60	20.	9.13E-04	6.984E+01	0.E+00
46	hf_46	HFhf_46	zn	zone_1	zn	zone_5	20.	5.04E-05	5.264E+00	0.E+00
47	hf_47	HFhf_47	zn	zone_2	zn	zone_6	20.	-1.85E-05	0.E+00	1.928E+00
48	hf_48	HFhf_48	zn	zone_3	zn	zone_7	20.	-3.82E-05	0.E+00	9.751E+00
49	hf_49	HFhf_49	zn	zone_4	zn	zone_8	20.	-4.57E-05	0.E+00	1.167E+01
50	hf_50	HFhf_50	zn	zone_5	zn	zone_9	20.	-4.94E-05	0.E+00	5.16E+00
51	hf_51	HFhf_51	zn	zone_6	zn	zone_10	20.	1.53E-05	1.602E+00	0.E+00
52	hf_52	HFhf_52	zn	zone_7	zn	zone_11	20.	3.48E-05	8.875E+00	0.E+00
53	hf_53	HFhf_53	zn	zone_8	zn	zone_12	20.	3.44E-05	8.77E+00	0.E+00
54	hf_54	HFhf_54	zn	zone_13	zn	zone_17	20.	-7.15E-05	0.E+00	7.46E+00
55	hf_55	HFhf_55	zn	zone_14	zn	zone_18	20.	1.73E-05	1.803E+00	0.E+00
56	hf_56	HFhf_56	zn	zone_15	zn	zone_19	20.	6.77E-05	1.728E+01	0.E+00
57	hf_57	HFhf_57	zn	zone_16	zn	zone_20	20.	1.53E-04	3.155E+01	0.E+00
58	hf_58	HFhf_58	zn	zone_17	zn	zone_21	20.	6.06E-05	6.33E+00	0.E+00
59	hf_59	HFhf_59	zn	zone_18	zn	zone_22	20.	-2.82E-05	0.E+00	2.946E+00
60	hf_60	HFhf_60	zn	zone_19	zn	zone_23	20.	-9.03E-05	0.E+00	2.304E+01
61	hf_61	HFhf_61	zn	zone_20	zn	zone_24	20.	-1.63E-04	0.E+00	3.253E+01
62	hf_62	HFhf_62	zn	zone_25	zn	zone_29	20.	3.02E-05	3.148E+00	0.E+00
63	hf_63	HFhf_63	zn	zone_26	zn	zone_30	20.	4.86E-06	5.072E-01	0.E+00
64	hf_64	HFhf_64	zn	zone_27	zn	zone_31	20.	-3.69E-05	0.E+00	9.404E+00
65	hf_65	HFhf_65	zn	zone_28	zn	zone_32	20.	-1.37E-04	0.E+00	2.982E+01
66	hf_66	HFhf_66	zn	zone_29	zn	zone_33	20.	-2.04E-05	0.E+00	2.128E+00
67	hf_67	HFhf_67	zn	zone_30	zn	zone_34	20.	6.9E-06	7.2E-01	0.E+00
68	hf_68	HFhf_68	zn	zone_31	zn	zone_35	20.	5.32E-05	1.357E+01	0.E+00
69	hf_69	HFhf_69	zn	zone_32	zn	zone_36	20.	1.49E-04	3.117E+01	0.E+00
70	hf_70	HFhf_70	zn	zone_37	zn	zone_41	20.	1.18E-03	3.574E+01	0.E+00
71	hf_71	HFhf_71	zn	zone_38	zn	zone_42	20.	4.77E-04	2.274E+01	0.E+00
72	hf_72	HFhf_72	zn	zone_39	zn	zone_43	20.	1.29E-04	2.891E+01	0.E+00
73	hf_73	HFhf_73	zn	zone_40	zn	zone_44	20.	2.64E-04	4.132E+01	0.E+00
74	hf_74	HFhf_74	zn	zone_41	zn	zone_45	20.	-1.16E-03	0.E+00	3.553E+01
75	hf_75	HFhf_75	zn	zone_42	zn	zone_46	20.	-4.59E-04	0.E+00	2.231E+01
76	hf_76	HFhf_76	zn	zone_43	zn	zone_47	20.	-9.33E-05	0.E+00	2.375E+01
77	hf_77	HFhf_77	zn	zone_44	zn	zone_48	20.	-2.43E-04	0.E+00	3.962E+01
78	hf_78	HFhf_78	zn	zone_49	zn	zone_53	20.	-1.49E-03	0.E+00	4.002E+01
79	hf_79	HFhf_79	zn	zone_50	zn	zone_54	20.	-5.79E-04	0.E+00	2.501E+01
80	hf_80	HFhf_80	zn	zone_51	zn	zone_55	20.	-1.03E-04	0.E+00	2.574E+01
81	hf_81	HFhf_81	zn	zone_52	zn	zone_56	20.	-1.17E-04	0.E+00	2.747E+01
82	hf_82	HFhf_82	zn	zone_53	zn	zone_57	20.	1.48E-03	4.E+01	0.E+00
83	hf_83	HFhf_83	zn	zone_54	zn	zone_58	20.	5.75E-04	2.491E+01	0.E+00
84	hf_84	HFhf_84	zn	zone_55	zn	zone_59	20.	9.09E-05	2.311E+01	0.E+00
85	hf_85	HFhf_85	zn	zone_56	zn	zone_60	20.	1.21E-04	2.797E+01	0.E+00
86	hf_86	HFhf_86	zn	zone_56	sp	0Pa	20.	1.05E-01	2.996E+01	0.E+00
87	vf_1	VFvf_1	zn	zone_1	zn	zone_13	20.	5.91E+00	0.E+00	3.798E+01
88	vf_2	VFvf_2	zn	zone_2	zn	zone_14	20.	5.91E+00	7.628E+00	0.E+00
89	vf_3	VFvf_3	zn	zone_3	zn	zone_15	20.	5.91E+00	1.734E+01	0.E+00
90	vf_4	VFvf_4	zn	zone_4	zn	zone_16	20.	5.91E+00	3.109E+01	0.E+00
91	vf_5	VFvf_5	zn	zone_5	zn	zone_17	20.	5.91E+00	0.E+00	1.866E+01
92	vf_6	VFvf_6	zn	zone_6	zn	zone_18	20.	5.91E+00	0.E+00	1.909E+00
93	vf_7	VFvf_7	zn	zone_7	zn	zone_19	20.	5.91E+00	0.E+00	1.06E+01
94	vf_8	VFvf_8	zn	zone_8	zn	zone_20	20.	5.91E+00	0.E+00	9.924E-01
95	vf_9	VFvf_9	zn	zone_9	zn	zone_21	20.	5.91E+00	0.E+00	3.753E+01
96	vf_10	VFvf_10	zn	zone_10	zn	zone_22	20.	5.91E+00	6.991E+00	0.E+00
97	vf_11	VFvf_11	zn	zone_11	zn	zone_23	20.	5.91E+00	1.828E+01	0.E+00
98	vf_12	VFvf_12	zn	zone_12	zn	zone_24	20.	5.91E+00	2.635E+01	0.E+00
99	vf_13	VFvf_13	zn	zone_13	zn	zone_25	20.	5.91E+00	0.E+00	9.927E-01
100	vf_14	VFvf_14	zn	zone_14	zn	zone_26	20.	5.91E+00	6.507E-01	0.E+00
101	vf_15	VFvf_15	zn	zone_15	zn	zone_27	20.	5.91E+00	0.E+00	1.333E+01
102	vf_16	VFvf_16	zn	zone_16	zn	zone_28	20.	5.91E+00	0.E+00	1.142E+01
103	vf_17	VFvf_17	zn	zone_17	zn	zone_29	20.	5.91E+00	0.E+00	1.377E+01
104	vf_18	VFvf_18	zn	zone_18	zn	zone_30	20.	5.91E+00	0.E+00	6.016E-01

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105 vf_19  VFvf_19    zn zone_19  zn zone_31     20.  5.91E+00   4.776E+00     0.E+00
106 vf_20  VFvf_20    zn zone_20  zn zone_32     20.  5.91E+00   7.278E+01     0.E+00
107 vf_21  VFvf_21    zn zone_21  zn zone_33     20.  5.91E+00      0.E+00  1.667E+00
108 vf_22  VFvf_22    zn zone_22  zn zone_34     20.  5.91E+00   1.152E-01     0.E+00
109 vf_23  VFvf_23    zn zone_23  zn zone_35     20.  5.91E+00      0.E+00  2.241E+01
110 vf_24  VFvf_24    zn zone_24  zn zone_36     20.  5.91E+00      0.E+00  1.414E+01
111 vf_25  VFvf_25    zn zone_25  zn zone_37     20.  5.89E+00      0.E+00  8.757E+00
112 vf_26  VFvf_26    zn zone_26  zn zone_38     20.  5.89E+00   3.596E+00     0.E+00
113 vf_27  VFvf_27    zn zone_27  zn zone_39     20.  5.89E+00   5.218E+00     0.E+00
114 vf_28  VFvf_28    zn zone_28  zn zone_40     20.  5.89E+00   1.042E+01     0.E+00
115 vf_29  VFvf_29    zn zone_29  zn zone_41     20.  5.89E+00      0.E+00  7.112E+00
116 vf_30  VFvf_30    zn zone_30  zn zone_42     20.  5.89E+00   7.171E+00     0.E+00
117 vf_31  VFvf_31    zn zone_31  zn zone_43     20.  5.89E+00   1.983E+00     0.E+00
118 vf_32  VFvf_32    zn zone_32  zn zone_44     20.  5.89E+00      0.E+00  1.774E+01
119 vf_33  VFvf_33    zn zone_33  zn zone_45     20.  5.89E+00      0.E+00  8.872E+00
120 vf_34  VFvf_34    zn zone_34  zn zone_46     20.  5.89E+00   3.687E+00     0.E+00
121 vf_35  VFvf_35    zn zone_35  zn zone_47     20.  5.89E+00   2.214E+00     0.E+00
122 vf_36  VFvf_36    zn zone_36  zn zone_48     20.  5.89E+00   8.198E+00     0.E+00
123 vf_37  VFvf_37    zn zone_37  zn zone_49     20.  5.87E+00      0.E+00  6.991E+00
124 vf_38  VFvf_38    zn zone_38  zn zone_50     20.  5.87E+00   1.917E+00     0.E+00
125 vf_39  VFvf_39    zn zone_39  zn zone_51     20.  5.87E+00      0.E+00  1.646E+01
126 vf_40  VFvf_40    zn zone_40  zn zone_52     20.  5.87E+00      0.E+00   9.67E+01
127 vf_41  VFvf_41    zn zone_41  zn zone_53     20.  5.87E+00   1.431E+02     0.E+00
128 vf_42  VFvf_42    zn zone_42  zn zone_54     20.  5.87E+00   5.327E+01     0.E+00
129 vf_43  VFvf_43    zn zone_43  zn zone_55     20.  5.87E+00    4.07E+01     0.E+00
130 vf_44  VFvf_44    zn zone_44  zn zone_56     20.  5.87E+00      0.E+00  2.888E+00
131 vf_45  VFvf_45    zn zone_45  zn zone_57     20.  5.87E+00      0.E+00  7.216E+00
132 vf_46  VFvf_46    zn zone_46  zn zone_58     20.  5.87E+00   1.935E+00     0.E+00
133 vf_47  VFvf_47    zn zone_47  zn zone_59     20.  5.87E+00      0.E+00   1.29E+01
134 vf_48  VFvf_48    zn zone_48  zn zone_60     20.  5.87E+00      0.E+00  9.781E+01
135 je_1   JEje_1     zn zone_53  sp 0Pa         20.  1.08E-01      0.E+00  2.995E+01
136 je_2   JEje_2     zn zone_53  zn zone_54     20.  1.11E-03   1.127E+01     0.E+00
137 je_3   JEje_3     zn zone_54  zn zone_55     20.  1.15E-03   1.594E+01     0.E+00
138 je_4   JEje_4     zn zone_55  zn zone_56     20.  8.83E-04   2.376E+01     0.E+00
===============================================================================

Pollutant transport output
==========================
Outside concentration mg/kg
 ExtNr    SF6
convers. 1.E+06

 2002jun12_00:00:00 Wednesday Pollutant Nr.          1(SF6)
   Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        mg/kg
    1.00          1.00               1.00       0.100E+07
-------------------------------------------------------------
  zone_1   0.         0.          0   0.            596.6
  zone_2   0.         0.          0   0.            595.4
  zone_3   0.         0.          0   0.            594.4
  zone_4   0.         0.          0   0.            593.4
  zone_5   0.         0.          0   0.            569.2
  zone_6   0.         0.          0   0.            573.9
  zone_7   0.         0.          0   0.            591.9
  zone_8   0.         0.          0   0.            591.7
  zone_9   0.         0.          0   0.            612.9
  zone_10  0.         0.          0   0.            611.1
  zone_11  0.         0.          0   0.            606.4
  zone_12  0.         0.          0   0.            601.5
  zone_13  0.         0.          0   0.            596.6
  zone_14  0.         0.          0   0.            616.7
  zone_15  0.         0.          0   0.            623.3
  zone_16  0.         0.          0   0.            579.9
  zone_17  0.         0.          0   0.            549.2
  zone_18  0.         0.          0   0.            644.3
  zone_19  0.         0.          0   0.            638.6
  zone_20  0.         0.          0   0.            588.1
  zone_21  0.         0.          0   0.            612.9
  zone_22  0.         0.          0   0.            641.7
  zone_23  0.         0.          0   0.            649.9
  zone_24  0.         0.          0   0.            581.1
  zone_25  0.         0.          0   0.            368.9
  zone_26  0.         0.          0   0.            402.4
  zone_27  0.         0.          0   0.            697.5
  zone_28  0.         0.          0   0.            543.2
  zone_29  0.         0.          0   0.            420.4
  zone_30  0.         0.          0   0.            840.2
```

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  zone_31  2.943E-06  0.           0   0.             864.6
  zone_32  0.         0.           0   0.             543.2
  zone_33  0.         0.           0   0.             358.4
  zone_34  0.         0.           0   0.             423.6
  zone_35  0.         0.           0   0.             709.9
  zone_36  0.         0.           0   0.             543.2
  zone_37  0.         0.           0   0.             368.9
  zone_38  0.         0.           0   0.             378.8
  zone_39  0.         0.           0   0.             377.4
  zone_40  0.         0.           0   0.             361.4
  zone_41  0.         0.           0   0.             381.7
  zone_42  0.         0.           0   0.             398.
  zone_43  0.         0.           0   0.             372.7
  zone_44  0.         0.           0   0.             359.
  zone_45  0.         0.           0   0.             358.4
  zone_46  0.         0.           0   0.             366.7
  zone_47  0.         0.           0   0.             363.
  zone_48  0.         0.           0   0.             356.8
  zone_49  0.         0.           0   0.             315.6
  zone_50  0.         0.           0   0.             330.1
  zone_51  0.         0.           0   0.             337.2
  zone_52  0.         0.           0   0.             341.9
  zone_53  0.         0.           0   0.             315.6
  zone_54  0.         0.           0   0.             345.6
  zone_55  0.         0.           0   0.             353.7
  zone_56  0.         0.           0   0.             353.6
  zone_57  0.         0.           0   0.             315.6
  zone_58  0.         0.           0   0.             329.8
  zone_59  0.         0.           0   0.             336.5
  zone_60  0.         0.           0   0.             341.4
Cave=
   493.92071533

Steady state solution:
----------------------

 2002jun12_00:00:00 Wednesday Pollutant Nr.          1(SF6)
   Zone-ID Source Occupant-Source  NrOcc Sink    Concentration
         kg/s       kg/s             kg/s        mg/kg
    1.00         1.00              1.00        0.100E+07
----------------------------------------------------------
  zone_1   0.         0.           0   0.             598.2
  zone_2   0.         0.           0   0.             596.9
  zone_3   0.         0.           0   0.             595.8
  zone_4   0.         0.           0   0.             594.6
  zone_5   0.         0.           0   0.             570.
  zone_6   0.         0.           0   0.             574.6
  zone_7   0.         0.           0   0.             592.8
  zone_8   0.         0.           0   0.             592.6
  zone_9   0.         0.           0   0.             614.5
  zone_10  0.         0.           0   0.             612.7
  zone_11  0.         0.           0   0.             607.7
  zone_12  0.         0.           0   0.             602.7
  zone_13  0.         0.           0   0.             598.2
  zone_14  0.         0.           0   0.             618.2
  zone_15  0.         0.           0   0.             624.8
  zone_16  0.         0.           0   0.             581.1
  zone_17  0.         0.           0   0.             549.7
  zone_18  0.         0.           0   0.             644.3
  zone_19  0.         0.           0   0.             639.9
  zone_20  0.         0.           0   0.             589.3
  zone_21  0.         0.           0   0.             614.5
  zone_22  0.         0.           0   0.             642.9
  zone_23  0.         0.           0   0.             651.1
  zone_24  0.         0.           0   0.             582.3
  zone_25  0.         0.           0   0.             368.6
  zone_26  0.         0.           0   0.             399.5
  zone_27  0.         0.           0   0.             698.6
  zone_28  0.         0.           0   0.             544.2
  zone_29  0.         0.           0   0.             421.4
  zone_30  0.         0.           0   0.             842.6
  zone_31  2.943E-06  0.           0   0.             866.7
  zone_32  0.         0.           0   0.             544.2
  zone_33  0.         0.           0   0.             358.8
  zone_34  0.         0.           0   0.             423.2
  zone_35  0.         0.           0   0.             710.9
  zone_36  0.         0.           0   0.             544.2
```

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  zone_37  0.         0.           0   0.            368.6
  zone_38  0.         0.           0   0.            378.5
  zone_39  0.         0.           0   0.            377.2
  zone_40  0.         0.           0   0.            361.7
  zone_41  0.         0.           0   0.            381.9
  zone_42  0.         0.           0   0.            398.3
  zone_43  0.         0.           0   0.            372.8
  zone_44  0.         0.           0   0.            359.3
  zone_45  0.         0.           0   0.            358.8
  zone_46  0.         0.           0   0.            367.1
  zone_47  0.         0.           0   0.            363.6
  zone_48  0.         0.           0   0.            357.2
  zone_49  0.         0.           0   0.            315.8
  zone_50  0.         0.           0   0.            330.3
  zone_51  0.         0.           0   0.            337.4
  zone_52  0.         0.           0   0.            342.
  zone_53  0.         0.           0   0.            315.8
  zone_54  0.         0.           0   0.            345.8
  zone_55  0.         0.           0   0.            353.8
  zone_56  0.         0.           0   0.            353.8
  zone_57  0.         0.           0   0.            315.8
  zone_58  0.         0.           0   0.            330.
  zone_59  0.         0.           0   0.            336.6
  zone_60  0.         0.           0   0.            341.5
Cave=
   494.59893799


******************************************************************************

Mean Values
===========

 KeyWord   Li/Zo-Name       Value         Unit
----------------------------------------------
    PZ-T  zone_40        0.597898E+0001   Pa
    PZ-T  zone_39        0.597817E+0001   Pa
    PZ-T  zone_38        0.597753E+0001   Pa
    PZ-T  zone_37        0.597727E+0001   Pa
    PZ-T  zone_36        0.118695E+0002   Pa
    PZ-T  zone_35        0.118695E+0002   Pa
    PZ-T  zone_34        0.118695E+0002   Pa
    TZ-T  zone_40        0.213407E+0002   C
    TZ-T  zone_39        0.212805E+0002   C
    TZ-T  zone_38        0.211660E+0002   C
    TZ-T  zone_37        0.210344E+0002   C
    TZ-T  zone_36        0.200516E+0002   C
    TZ-T  zone_35        0.200242E+0002   C
    TZ-T  zone_34        0.200852E+0002   C
    TZ-T  zone_33        0.201860E+0002   C
    TZ-T  zone_32        0.200893E+0002   C
    TZ-T  zone_31        0.200505E+0002   C
    TZ-T  zone_30        0.200527E+0002   C
    TZ-T  zone_29        0.200928E+0002   C
    TZ-T  zone_28        0.200648E+0002   C
    TZ-T  zone_27        0.200450E+0002   C
    TZ-T  zone_26        0.200937E+0002   C
    TZ-T  zone_25        0.201911E+0002   C
    TZ-T  zone_24        0.197951E+0002   C
    TZ-T  zone_23        0.198199E+0002   C
    TZ-T  zone_22        0.197761E+0002   C
    TZ-T  zone_21        0.196937E+0002   C
    TZ-T  zone_20        0.198084E+0002   C
    TZ-T  zone_19        0.198134E+0002   C
    TZ-T  zone_18        0.198120E+0002   C
    TZ-T  zone_17        0.197721E+0002   C
    TZ-T  zone_16        0.197846E+0002   C
    TZ-T  zone_15        0.198047E+0002   C
    TZ-T  zone_14        0.197684E+0002   C
    TZ-T  zone_13        0.196886E+0002   C
    TZ-T  zone_12        0.195918E+0002   C
    TZ-T  zone_11        0.195542E+0002   C
    TZ-T  zone_10        0.195723E+0002   C
    TZ-T  zone_9         0.195843E+0002   C
    TZ-T  zone_8         0.195538E+0002   C
    TZ-T  zone_7         0.195424E+0002   C
    TZ-T  zone_6         0.195279E+0002   C
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TZ-T	zone_5	0.195403E+0002	C
TZ-T	zone_4	0.196032E+0002	C
TZ-T	zone_3	0.195672E+0002	C
TZ-T	zone_2	0.195790E+0002	C
TZ-T	zone_1	0.195861E+0002	C
FZ-T	zone_40	0.107110E+0003	kg/h
FZ-T	zone_39	0.874829E+0002	kg/h
FZ-T	zone_38	0.621852E+0002	kg/h
FZ-T	zone_37	0.445233E+0002	kg/h
FZ-T	zone_36	0.311676E+0002	kg/h
FZ-T	zone_35	0.246212E+0002	kg/h
FZ-T	zone_34	0.591946E+0001	kg/h
FL-T	hf_30	-0.657949E+0002	kg/h
FL-T	hf_29	-0.585600E+0002	kg/h
FL-T	hf_28	-0.375190E+0002	kg/h
FL-T	hf_27	-0.884450E+0001	kg/h
FL-T	hf_28	-0.375190E+0002	kg/h
FL-T	hf_25	0.507190E+0001	kg/h
FL-T	hf_24	-0.295520E+0002	kg/h
FL-T	vf_36	0.815834E+0001	kg/h
FL-T	vf_35	0.219271E+0001	kg/h
FL-T	vf_34	0.371873E+0001	kg/h
FL-T	vf_33	-0.889906E+0001	kg/h
FL-T	vf_32	-0.177434E+0002	kg/h